Gov.Doc. Canada. Mines, Bureau of
Can Gold in Canada,1935, by
M A.H.A.Robinson. (No.769).

3 1761 11411468 9

LIBRARY

.Doc
n

University of Toronto Library
SCIENCE & MEDICINE DEPARTMENT

Canada, Mines,

CANADA

DEPARTMENT OF MINES

HON. W. A. GORDON, MINISTER; CHARLES CAMSELL, DEPUTY MINISTER

MINES BRANCH

JOHN McLEISH, DIRECTOR

DEC 6 1935

Gold in Canada

1935

BY

A. H. A. Robinson

1935
J. O. PATENAUDE, I.S.O.
PRINTER TO THE KING'S MOST EXCELLENT MAJESTY
OTTAWA

Price, 25 cents

No. 769

Canada. Mines, Bureau of-

CANADA

DEPARTMENT OF MINES

HON. W. A. GORDON, MINISTER; CHARLES CAMSELL, DEPUTY MINISTER

MINES BRANCH

JOHN McLEISH, DIRECTOR

Gold in Canada

1935

BY

A. H. A. Robinson

1935
J. O. PATENAUDE, I.S.O.
PRINTER TO THE KING'S MOST EXCELLENT MAJESTY
OTTAWA

Price, 25 cents

No. 769

Digitized by the Internet Archive
in 2026 with funding from
University of Toronto

https://archive.org/details/31761114114689

PREFACE

This report—the first edition of which, under the title "Gold in Canada" was issued under date of June 18, 1932, and the second edition "Gold in Canada, 1933," under date of July 5, 1933—describes briefly the character and extent of the mining and production operations at the principal gold mines in Canada. The statistical records and industrial descriptions are prefaced by short discussions of such topics as the physical and chemical properties of gold; its rarity and mode of occurrence; the history of the world's gold production; the types of ore from which it is produced; and the history of its production in Canada.

The total number of properties described is 70, as compared with 32 in the 1933 edition. Free use has been made of reports to shareholders and other information furnished by the companies themselves, and the records of assays and of ore reserves are derived from such sources.

The rapid development of the industry, the bringing into operation of new mines, and the exhaustion of the previous edition have been the reasons necessitating the printing of this third edition, in which the statistical data and the descriptive matter have as far as possible been brought up to date to include the year 1934.

The Geological Survey of this Department has published a geological report on Gold Occurrences of Canada.

JOHN McLEISH,
Director, Mines Branch.

September 16, 1935.

CONTENTS

PAGE

Preface iii

CHAPTER I

Introductory 1
The gold standard; and the economic importance of gold 2
Properties of gold 4
Alloys of gold 7
Rarity of gold 10
Modes of occurrence of, and methods of winning gold 11
History of gold 15
Eras of world gold production 19

CHAPTER II

Gold Mining in Canada 23
Historical 23
Sources of Canada's gold 26
Canada's place among gold-producing countries 31

CHAPTER III

Some Canadian Producing Gold Mines 33
Yukon 33
British Columbia 35
    Bralorne mine 39
    Cariboo Gold Quartz mine 40
    Dentonia mine 41
    Island Mountain mine 42
    Kootenay Belle mine 43
    Minto mine 43
    Pioneer mine 44
    Premier mine 45
    Queen mine 46
    Reno mine 47
    Second Relief mine 49
    Vidette mine 50
    Wayside mine 50
    Windpass mine 51
    Ymir Yankee Girl mine 51
Alberta 52
Saskatchewan 53
Manitoba 54
    Central Manitoba mine 57
    Diana (formerly Gem) mine 58
    Flin Flon mine 59
    God's Lake mine 60
    Island Lake mine 61
    San Antonio mine 62
    Sherritt-Gordon mine 63

Page
Ontario........ 63
  Porcupine gold belt........ 67
    Amalgamated Goldfields (Blue Quartz) mine........ 71
    Buffalo-Ankerite mine........ 71
    Coniaurum mine........ 72
    Dome mine........ 74
    Hollinger mine........ 77
    McIntyre mine........ 78
    Marbuan (March Gold) mine........ 80
    Paymaster Consolidated mine........ 81
    Vipond (Anglo-Huronian) mine........ 83
  Kirkland Lake gold belt........ 85
    Barry-Hollinger (formerly Patricia) mine........ 89
    Bidgood mine........ 90
    Kirkland Lake Gold mine........ 91
    Lake Shore mine........ 92
    Macassa mine........ 93
    Moffatt-Hall mine........ 94
    Sylvanite mine........ 95
    Teck-Hughes mine........ 96
    Toburn (Tough-Oakes-Burnside) mine........ 97
    Wright-Hargreaves mine........ 99
  Matachewan area........ 100
    Ashley mine........ 100
    Matachewan Consolidated mine........ 101
    Young-Davidson mine........ 101
  Northwestern Ontario........ 102
    Ardeen (Moss) mine........ 102
    Algoma Summit (McCarthy-Webb) mine........ 103
    Casey Summit mine........ 104
    Central Patricia mine........ 105
    Dikdik mine........ 105
    Howey mine........ 106
    Jackson-Manion (J-M Consolidated) mine........ 107
    Lebel Oro (Long Lake) mine........ 108
    Little Long Lac mine........ 108
    McKenzie-Red Lake mine........ 109
    McMillan mine........ 110
    Minto mine........ 110
    Northern Empire mine........ 111
    Parkhill mine........ 112
    Pickle Crow mine........ 112
    St. Anthony mine........ 113
Quebec........ 114
    Canadian Malartic mine........ 116
    Beattie mine........ 116
    Granada mine........ 118
    Greene-Stabell mine........ 118
    Lamaque mine........ 119
    McWatters mine........ 120

PAGE
Noranda (Horne) mine........ 120
O'Brien mine........ 122
Siscoe mine........ 123
Sullivan Consolidated mine........ 124
Nova Scotia........ 125

TABLES

Table I. World production of gold........ 21
II. Estimated average monthly value of an ounce of fine gold expressed in Canadian funds........ 24
III. Production of gold in Canada 1858-1934........ 24
IV. Sources of Canadian fine gold production by percentages, 1931-1934........ 26
V. Production of new gold in Canada by provinces and by sources, 1933 and 1934........ 27
VI. Ores mined and milled, crude bullion recovered, and crude bullion and concentrates shipped from auriferous quartz mines in Canada in 1933 and 1934........ 28
VII. Shipments from copper-gold-silver mines of Canada, 1933 and 1934........ 29
VIII. Principal statistics of the gold mining industry in Canada, 1925-1934........ 30
IX. Annual gold production of the world and of the chief gold-producing countries, 1901-1934........ 31
X. Canadian lode mines producing 20,000 ounces and upward of fine gold in 1934........ 33
XI. Total production of gold from Yukon, 1885-1934........ 34
XII. Lode gold production of Yukon, 1910-1934........ 34
XIII. Placer gold production of British Columbia, 1858-1934........ 38
XIV. Lode gold production of British Columbia, 1893-1934........ 39
XV. Production record of Bralorne mine, 1932-1934........ 40
XVI. Production and dividend record of Premier gold mine, 1919-1934. 46
XVII. Production of gold from Alberta, 1887-1934........ 53
XVIII. Production of gold from Saskatchewan, 1932-1934........ 53
XIX. Production of gold from Manitoba, 1917-1934........ 56
XX. Production record of San Antonio mine, 1932-1934........ 62
XXI. Gold milling plants at Ontario mines in 1934........ 64
XXII. Total gold production in Ontario, 1866-1934........ 66
XXIII. Sources of Ontario's gold production in 1934........ 66
XXIV. Value of total production by mines of the Porcupine belt, 1910-1934........ 68
XXV. Dividends and bonuses paid by Porcupine gold mining companies, 1912-1934........ 70
XXVI. Production record of Ankerite mine........ 72
XXVII. Production record of Coniaurum mine........ 73
XXVIII. Production record of Dome Mines, Ltd........ 76
XXIX. Production record of Hollinger mine........ 78
XXX. Production record of McIntyre Porcupine mine........ 80
XXXI. Production record of March Gold mine........ 81
XXXII. Production record of Vipond mine........ 84
XXXIII. Production of chief mines and total production of Porcupine camp, 1910-1934........ 84

PAGE

Table XXXIV. Production of gold and silver from the principal mines of the Kirkland Lake camp by mines and years.................. 86
XXXV. Value of total production by mines of the Kirkland Lake belt, 1913-1934.. 87
XXXVI. Dividends and bonuses paid by Kirkland Lake gold mining companies, 1915-1934.................................... 88
XXXVII. Production record of Barry-Hollinger mine.................... 89
XXXVIII. Production record of Kirkland Lake gold mine................ 92
XXXIX. Production record of Lake Shore mine........................ 93
XL. Production record of Sylvanite mine.......................... 95
XLI. Production record of Teck-Hughes mine....................... 97
XLII. Production record of Tough-Oakes-Burnside mine.............. 99
XLIII. Production record of Toburn mine........................... 99
XLIV. Production record of Wright-Hargreaves mine................. 100
XLV. Production record of Howey mine, 1930-1934.................. 107
XLVI. Production of gold from Quebec ore, 1877-1934............... 114
XLVII. Production record of Beattie mine.......................... 117
XLVIII. Output of the Noranda smelter, 1927-1934.................. 122
XLIX. Production record of Siscoe mine............................ 124
L. Production of gold from Nova Scotia ores, 1862-1934........... 127

ILLUSTRATIONS

Drawings

Figure 1. Production of gold in the main producing countries, 1840-1934......... 20
2. Production of gold in Canada, 1858-1934......................... 25
3. Key map of gold-bearing areas in Manitoba....................... 55
4. Key map of gold-bearing areas in Ontario........................ 66
5. Key map of chief producing gold mines in Porcupine area, Ontario...... 67
6. Key map of chief producing gold mines of Kirkland Lake area, Ontario 85
7. Key map of gold-bearing areas in Quebec......................... 115

GOLD IN CANADA, 1935

CHAPTER I

INTRODUCTORY

The object of man's cupidity from the earliest times, gold has been perhaps more influential than any other metal in shaping the course of human history. The lure of gold has drawn men to the remotest corners of the earth and thus paved the way for settlement and civilization in many new countries. It has been a fruitful source of wars and of many other of the strenuous activities, both good and evil, of the human race. A somewhat remarkable fact regarding the influence that has been exercised on human affairs by gold is that this has not been due to any intrinsic, specially useful qualities of the metal but to the importance that has been attached to its mere possession. In other words the value placed upon gold is purely symbolic; at no time has it been desired merely for the industrial uses to which it could be put and the material services it could render to mankind. Valued at first as an ornamental substance of considerable rarity, it soon became a common intermediary in barter and exchange, a function which it has shared at different times and places with silver, copper, iron, and even salt, corn, oxen, cloth, beaver skins, and shells. The acceptability of substances other than gold for monetary purposes, with the exception of silver, has, however, always been confined within comparatively narrow limits in time and space; so that gold, always and everywhere held in high esteem, finally became an accepted standard of value throughout the greatest part of the civilized world.

> Gold, if we reflect upon it, is something like stored up vital force; it is labour, it is energy in the potential state—energy which has been somehow condensed in the little metallic discs by the pains spent in wresting them from the earth; after which, passing from hand to hand, they excite at every move an amount of labour equal to that which was necessary for their acquisition simply as a price paid for the exchange and without losing anything themselves; moreover, the quicker they circulate the more labour they produce.[1]

Outside its chief use as a standard of value and medium of exchange, the value of gold depends almost entirely on its attractiveness from the decorative point of view, and the ease with which it can be worked into any desired form. At first, plate and jewellery were beaten by hand out of solid gold, and many solid gold articles are still made though machinery has largely replaced hand work. Later, methods were devised by which thin coatings of gold could be applied to base metals, or their alloys, and thus articles having all the outward attractiveness of gold could be produced at a small fraction of the cost of similar articles of solid gold. Rolled gold, out of which much of the cheaper kinds of jewellery, watch cases, spectacle frames, and so on are made, is produced by placing a block of backing metal between plates of gold of any fineness desired and then rolling the composite block down to the required thickness. In this way coatings of gold as thin as one fifty-thousandth of an inch can be produced. Articles may also be coated with a thin film of gold deposited electrolytically from a bath of potassium aurocyanide. Gold leaf, used for gilding articles as diverse as book-bindings and the ball and cross of St. Paul's Cathedral, is made by rolling a sheet of gold down to a thickness of about one one-thousandth of an inch and then beating it with hammers, first between sheets of vellum and then between sheets of "gold-beaters' skin." Gold leaf as thin as one three-hundred-thousandth of an inch can be so produced.

---

[1] De Launay, L.: "The World's Gold," G. P. Putman's Sons, New York, 1908, p. 239.

Special gold-silver and gold-silver-platinum alloys are used in electric contact work; certain surgical instruments are made in 14-carat gold as are also the nibs and feeding tubes of the better type of fountain pens; and gold alloyed with about 5 per cent platinum, to harden it, finds some small use in laboratory crucibles. An alloy of gold and platinum is used in what is said to be the best type of spinneret used in the artificial silk industry. The present high price and difficulty of obtaining gold has caused platinum and palladium to be substituted in many of its industrial uses.

THE GOLD STANDARD; AND THE ECONOMIC IMPORTANCE OF GOLD

The measuring, for purposes of trade, of all commodities by one and the same standard of value is highly desirable, because a common currency basis facilitates trade between countries by preventing wide variations in currency exchange. It is also desirable that the material chosen for this standard should, as far as possible, be one not liable to changes in its relationship to the whole body of commodities by reason of undue changes in its plentifulness or otherwise. Gold, which is freely accepted in return for all services and in exchange for all other commodities in all parts of the globe, is the material most countries have decided is best adapted to fulfil this requirement.

> Its success in this capacity is not absolute, for the production of gold naturally does not expand or contract in correspondence with cycles of prosperity or of depression in the world's trade, nor can it be relied upon to increase in just relation to that of the world's population, nor can supplies be adjusted automatically to any reduction in its use caused by the adoption of other methods of payment. On the contrary the search for gold continues, whether additional supplies of the metal be needed for the world's currency or not, since the output can always be turned into money and applied to the purchase of desirable commodities.[1]

The gold standard simply means that in countries in which it is in force gold is the basic money and standard of value and that all other kinds of currency are redeemable in gold.

> In currency systems based upon a gold standard, a unit of money containing a certain defined quantity of fine gold is designated, but it does not follow necessarily either that there is occasion to mint the coin, or, if it be minted, that it circulates within the country of origin. Hence, something more than the mere existence of a gold standard coin is necessary to render gold an effective basis of currency.[2]

---

[1] White, Benjamin: " Gold, Its Place in the Economy of Mankind "; Pitman's Common Commodities and Industries Series; Sir Isaac Pitman & Sons, Ltd., London, Melbourne, and New York, p. 76.

[2] Ibid, p. 80.

The gold standard does not imply that legal tender currency should actually consist of gold, but it does imply that the purchasing power of such currency should be equivalent to that of the defined quantities of gold in the monetary units it represents; in other words, in gold standard countries the value of money must be kept in a fixed ratio to gold. In order to do this, under the gold standard, governments and banks issuing money notes are required to maintain the fixed ratio of money to gold, i.e. maintain their credit by keeping on hand adequate reserves of gold; and be prepared to hand out in gold the face value of such notes when called upon to do so.

> Provided confidence exists in the issuing authority, it is practically immaterial of what substance money be composed. Articles of the most varied character, feathers, dried fish, rum, etc., have been employed in this way, their usefulness being somewhat marred by their perishable character. In highly civilized communities the tendency is for money to be expressed by a material practically of no intrinsic value at all, namely, paper, but possessing effective value as a lien upon the credit of the issuing authority. It is of supreme importance, however, that a state should enjoy the confidence of its subjects as to one important detail, namely, that when they have occasion to discharge indebtedness, incurred by them outside the state, the money in their hands—be it silver, copper, or paper—shall be exchangeable into currency considered good enough for their connexions abroad without loss to the present holders. Gold currency is almost universally thus accepted (White).[1]

At the present time little gold coin actually circulates from hand to hand, but stocks of gold accumulated by governments and bankers form the essential foundation of our paper currency and of the vast modern system of credit relations; and in the settlement of international trade balances considerable quantities of gold are frequently transferred from one country to another. The real economic function of gold to-day is to serve as a basis of fiduciary note issues and as a medium for the adjustment of trade balances between countries; and for both these purposes stamped standard gold bars are now in more general use than coinage.

> There is a popular notion that a country can stay on the gold standard simply by refusing to pay out gold for export and thereby maintaining the legal gold reserves. But the mere existence of reserves has nothing to do with the gold standard. This is demonstrated by the fact that England has held her legal minimum gold reserve all along, while she has admittedly been off the gold standard since the Bank of England refused to sell gold last September. Obviously, gold that is to be kept immobile in bank vaults might just as well have been left immobile in the gold mines—except for the magic confidence-producing effects which an unseen, unapproachable gold reserve exercises upon a non-comprehending public. It is not the mere existence of gold but the unhampered movement of gold, resulting in stable exchange rates, that is the essence of the gold standard.[2]

Historically, the single gold standard is a comparatively recent innovation. Up till sometime in the Middle Ages the world's monetary systems may be broadly described as based on a double standard of silver and gold. Beginning with the eighth century a single silver standard of coinage became prevalent and remained so until some time in the thirteenth century when the double standard of gold and silver was again introduced and remained in vogue until well on in the nineteenth century.

---

[1] Ibid, p. 80.

[2] Plumptre, A. F. W.: " The Gold Standard. How it Grew and What it Means "; University of Toronto Monthly, November, 1931.

> The pre-eminence of gold as *the* monetary metal is quite a new thing; and it is due to an historical accident. An English coinage act of 1816 provided that from a day to be fixed by Royal Proclamation the mint should buy and coin silver at a price of 62 shillings an ounce. The object was that gold and silver coinage should both be used in England . . . . However, no proclamation was made, and England was safe for the gold standard.
>
> When England, in the second half of the century, had risen to a place of commercial predominance, other nations found it desirable to have the same standard. The English pound was exchangeable into a fixed weight of gold. By making their currencies legally exchangeable into fixed weights of gold the others made them exchangeable also into fixed numbers of English pounds. Thus when two countries are both on the gold standard the exchange rate between their currency is thereby fixed. And the more countries adopted the standard the more desirable it became for other countries to abandon silver or other standards and join the fixed-exchange-rate union of the gold standard.[1]

Portugal followed England on to the gold standard in 1854; Germany in 1871; the United States, in 1873; the Scandinavian countries, in 1874; Holland, in 1875; France and the Latin Union, in 1876; Austria-Hungary, in 1892; British India, in 1893; Japan, in 1898; and Russia, in 1899. Up to the present China is the only country of importance that has failed to adopt the gold standard; and those countries that have once adopted it have adhered to it except when compelled to abandon it on account of wars and financial crises.

PROPERTIES OF GOLD

A number of the properties of gold adapt it specially for the different uses to which it is put; others facilitate its recovery from its ores. Its ductility and malleability for instance make it easy not only to work gold into ornamental shapes, but also to strike it into coin. Its weight which, as compared with its bulk, is noticeably greater than that of any other substance ordinarily met with, makes it possible to transport or store gold to great value in small space. Thus, it can be identified with ease and certainty by its characteristic colour, lustre, and weight; it is easily subdivided into pieces of any required size—an extremely useful property in a medium of exchange; and can be transported with comparative ease and safety by reason of its small bulk. Furthermore, the ease with which it can be secreted and its universal desirability make it well adapted to serve as a store of unchanging wealth reserved for future needs.

In winning gold from its ores, its weight, its solubility in mercury, in chlorine solutions, and in solutions of cyanide salts are all made use of.

Physical Properties

Gold, in the mass, is distinguished from all other metals by its characteristic yellow colour; and its high metallic lustre remains untarnished indefinitely under all ordinary conditions. The colour of pure gold is, however, seldom seen, as gold whether as found in nature or in the form of wrought gold is virtually always alloyed with some other metal or metals which modify its tint. Some of the purest native gold that has been found is said to have come from Pike's Peak mine at Cripple Creek,

---

[1] Plumptre, A. F. W.: "The Gold Standard. How it Grew and What it Means"; University of Toronto Monthly, November, 1931.

Colorado, and to have contained 99·9 per cent pure gold. Gold from the Mount Morgan mine, in Australia, also is said to have been 99·7 per cent pure. In the arts, some gold leaf is nearly pure gold; and the colour of pure gold is closely imitated in certain alloys of gold, silver, and copper used in the manufacture of 18- and 22-carat gold wares. The colour of gold becomes paler when alloyed with silver. Ten to twenty-five per cent silver is said by some to give it also a greenish hue; with 60 per cent or more the colour is silver-white. Alloyed with copper it is reddish; and with zinc greenish. White gold may be made by alloying with nickel, if hardness also is desired, or with palladium if it is to be soft.

Composition of Some Commercial Gold Alloys

Alloy	Parts in twenty-four					
	Fine gold	Silver	Copper	Iron	Nickel	Zinc
Red gold........	18	....	6	....	....	....
Green "	18	6	....	....	....	....
" "	14	8	2	....	....	....
Blue "	18	....	....	6	....	....
White "	12	12	....	....	....	....
" "	14	....	4½	....	5	½
" "	19	....	....	....	4½	½

Finely divided gold prepared by volatilization or deposited from solution assumes different colours such as violet, ruby, and reddish purple, the tint varying to dark brown and black. Gold leaf less than $^1/_{150,000}$ of an inch thick appears green—sometimes ruby—by transmitted light.

In hardness, gold corresponds to the number 979 in Bottone's scale, in which the diamond is 3010. It is a little harder than lead, but softer than copper, silver, platinum, zinc, and iron. In practice, it is always alloyed with other metals—usually copper or silver—to harden it and thus prevent undue loss by wear. The proportion of gold in an alloy is usually stated either in "fineness" or in "carats"; "fineness", i.e. the number of parts gold in 1,000 parts of alloy, being the term commonly used when speaking of bullion; "carats , i.e. the number of parts gold in 24 of alloy when speaking of commercial articles manufactured from gold. British standard gold coin is 916·6 fine (22 carats) and that of Canada and the United States 900 fine (21·6 carats); wedding rings are often made of 22-carat gold. In Great Britain the standard officially recognized for the manufacture of jewellery and plate, including such articles as cigarette cases, studs, links, spectacle frames, and so on, are 22, 18, 14, and 9 carats, the compositions of which are shown in the following table:—

Composition of English Standard (Hall-marked) Gold Wares in Parts per 1,000

Standard	Fine gold	Fine silver	Base metal, chiefly copper
22 carats	916·6	20	63·3
18 “	750·0	125	125·0
14 “	583·3	100	316·6
9 “	375·0	100	525·0

The 14-carat standard is new, replacing former 15- and 12-carat standards. Alloys lower than 9-carat cannot be hall-marked.

The density of gold varies considerably according to the treatment to which it has been subjected. The specific gravity of cast gold is about 19·3; this, by rolling, can be raised to 19·48 and by hammering to 19·65. The density of precipitated gold may go as high as 20·72.

Gold is the most malleable and ductile of all metals and retains these properties at all temperatures. One gramme of gold can be beaten into leaf sufficient to cover 6 square feet, that is, into leaf only 1/300,000 of an inch thick. One gramme of gold can also be drawn into a wire nearly 1½ miles in length, and an ounce of gold drawn over a silver wire is capable of being extended more than 1,300 miles.[1] A flat particle of gold weighing only 1/2,500,000 of a grain can be seen with the naked eye.

Pure gold has a tenacity of about seven tons to the square inch and elongates about 31 per cent before breaking. A wire one-tenth of an inch in diameter will support nearly 123 pounds. Alloys of gold with silver and copper are stronger still.

On heating, gold, like iron, can be welded below the point of fusion, and finely divided gold agglomerates on heating without being subjected to pressure. The finely divided metal, in the condition in which it is precipitated from solution, can be compressed cold into solid form between dies.

The melting point of gold is about 1,064°C., at which temperature it begins to volatilize.

It can be boiled readily in the heat of electric-arc furnaces or of the oxy-hydrogen blowpipe. Its vapour is purple.

The electrical conductivity of gold at ordinary temperatures is 76·7 if that of silver is taken as 100.

Chemical Properties

The alchemists called gold a "noble" metal, because if it were put in the fire and even melted it came out unchanged, whereas the "base" metals became oxidized and lost their metallic characteristics. Silver, the other noble metal, was considered less noble or perfect than gold because it could be dissolved in aqua fortis (nitric acid) which has little or no effect on gold. One of the chief characteristics of gold is the difficulty with which its compounds are formed and the ease with which they are decomposed, hence, gold, in nature, is usually found native, that is, in the metallic state and not in the form of a chemical compound.

---

[1] Stoughton and Butts; "Engineering Metallurgy," McGraw-Hill Book Co., Inc., New York and London, 1926.

Gold is not appreciably affected at any temperature by water or by air, hence its untarnishability; neither is it perceptibly attacked at ordinary temperatures by alkalis or by hydrochloric, nitric, or sulphuric acids, though boiling nitric or sulphuric acid will dissolve it slightly when it is in a finely divided state. On the other hand, it dissolves readily at ordinary temperatures in water containing chlorine, bromine, or a mixture of iodine and potassium iodide. It is also dissolved readily by a concentrated boiling solution of ferric chloride; and by any mixture producing nascent chlorine, bromine, or iodine. The most rapid solvent of gold is hot *aqua regia*—a mixture of three parts hydrochloric acid and one part nitric aid. A solution of sodium or potassium cyanide, in the presence of oxygen or an oxidizing agent dissolves it slowly at ordinary temperatures. In the solid state it unites readily with mercury to form alloys called *amalgams;* and dissolves in excess of that metal. Its reactions with respect to chlorine, mercury, and the cyanides of the alkali metals are the bases of the processes by which the greatest part of the world's gold is extracted from its ores.

Gold can usually be readily identified by its colour, its weight, its sectility, and by its not being attacked by hot nitric acid. If a confirmatory test is required the metal may be dissolved in aqua regia and the solution evaporated to dryness, with occasional additions of hydrochloric acid, at a temperature not above 100°C. If the residue is then dissolved in water and sulphurous acid gas passed through the liquid, a black or brown precipitate insoluble in nitric acid denotes the presence of gold.

The chemical compounds of gold are not numerous and have not been exhaustively studied. Its only *natural* compounds that are definitely known are tellurides, which are fairly abundant in some deposits. Possibly selenides and sulphides of gold also occur.

ALLOYS OF GOLD

Gold can be alloyed with nearly all other metals; but the precious-metal characteristics and value of the gold alloys are so predominant that they are not thought of as alloys at all but simply as different grades or kinds of gold. Up to recent years the prime object of alloying gold was to harden it so as to increase its resistance to wear, and at the same time retain its true gold colour and its good working qualities. Latterly, however, a demand has arisen for differing shades of gold that can be arranged in strips or woven into patterns in mesh or wire, so that to-day the worker in gold has at his command a variety of alloys that furnish him with many pastel shades and much gold used in the manufacture of commercial articles is no longer golden in colour.

Gold-Silver Alloys. Gold and silver when melted together unite in all proportions to form homogeneous alloys. The colour of gold-silver alloys becomes paler as the proportion of silver is increased, until when 50 per cent silver is present only a faint yellow tinge is perceptible; when they contain over 60 per cent silver they are silver-white. Gold alloyed with 10 to 25 per cent silver is said by some to have a greenish hue ("green gold").

Gold-silver alloys have been used in jewellery and in coins from very early times; coins of *electrum*—that is alloys containing 15 to 35 per cent silver—having been in use in Lydia (Greece) as early as about 720 B.C.

If alloys containing about 75 per cent and upward of silver are boiled in strong nitric or sulphuric acid, all the silver is dissolved out and the gold is left behind in the form of a porous brown skeleton or a brown powder—a fact that is taken advantage of for the separation of silver from gold in the process of refining.

Gold-Copper Alloys. Molten gold and copper are miscible in all proportions and separate only slightly on solidification. Gold-copper alloys have a reddish tinge, but if silver also is added the colouring effects of the two alloying metals counteract each other, so that a triple alloy can be made having a colour hardly distinguishable from that of pure gold.

British standard gold contains 91·6 per cent gold and 8·3 copper, though usually a small and variable part of the latter metal is replaced by silver. Canadian, United States, and French coins contain 90 per cent gold and 10 per cent copper.

Copper hardens gold, decreases its malleability, and increases its tensile strength. An alloy containing 18 per cent copper is so brittle it breaks under the hammer and British standard gold containing 8·3 per cent copper has a tensile strength of 16 tons per square inch as against 7 tons for pure gold.

In addition to coinage, gold-copper alloys (to which a little silver is usually added) are widely used for jewellery; pure gold and gold-silver alloys being too soft to stand ordinary wear without quickly becoming defaced. If alloys of gold and copper are heated in the air they blacken on the surface, owing to the formation of oxide of copper; but the black layer so formed can be removed by treatment with hot dilute sulphuric acid.

Gold-Mercury Alloys. Alloys of gold with mercury are known as *amalgams.* At 0°C. mercury will dissolve 0·11 per cent of its weight of gold; at 20°C., 0·126 per cent; and at 100°C., 0·65 per cent. Solutions containing less than these amounts of gold are, at ordinary temperatures, liquid alloys which, like mercury, are silver-white in colour and will pass through cloth or other filtering material unchanged. On the other hand, gold will absorb approximately six times its weight of mercury to form a silver-white solid amalgam containing about 13·5 per cent of gold. If more mercury is added the result is a saturated solution of gold in mercury in which solid particles of gold amalgam are suspended. These solid particles, being heavier than the liquid solution, will settle to the bottom and can be separated by filtration under pressure.

If mercury is brought into contact with a clean surface of solid gold it "wets" it, i.e. penetrates through it and makes it brittle. A gold coin or ring is immediately whitened by contact with mercury and can be broken with the fingers, the fractured surfaces being as white as the outside. The amount of mercury actually taken up, however, is small and virtually all of it can be got rid of by careful heating below red heat; but unless air has been excluded during the heating the article if it contains copper will be blackened.

The amalgams recovered in gold-mills using amalgamation processes are not true alloys but consist of mercury, enclosing particles of gold which the mercury has penetrated superficially. These mercury-coated particles after being separated out by straining through chamois or other suitable material constitute the amalgam of the gold-miner. This, from its nature, is variable in composition, generally containing between 20 and 50 per cent of gold; the proportion of gold being greatest when the average size of the gold particles is greatest. Much of the mercury can be distilled off from such amalgams well below red heat, leaving a residue containing about 75 per cent of gold; most of the remainder can be expelled at red heat; about 0·1 per cent, however, cannot be driven off under the melting point for gold. Mercury can be dissolved out of all amalgams by hot nitric acid, the gold being left behind as a spongy mass. If the reaction is kept very slow by using cold dilute acid, crystalline needles of nearly pure gold result.

Gold-Zinc Alloys. Alloys of gold and zinc containing less than 14 per cent of zinc are pale yellow in colour and of about the same hardness as gold; as the proportion of zinc is increased from 14 to 25 per cent the colour gradually changes to a beautiful reddish-lilac tint; but with further additions of zinc the lilac colour fades and the alloy becomes first white, then zinc-grey. All the alloys of gold and zinc are brittle—those containing 30 to 80 per cent of gold most so; that containing 39·8 per cent zinc being so hard it will scratch steel but is as brittle as glass. Gold-zinc alloys, like gold-silver alloys, can be " parted," i.e. the zinc can be dissolved out of them by nitric or dilute sulphuric acid. They are all completely soluble in aqua regia.

Gold-Tin Alloys. There are three definite compounds of gold and tin known, having compositions corresponding to the formulae $AuSn$, containing 62·4 per cent gold; $AuSn_2$, containing 45·5 per cent; and $AuSn_4$, containing 29·4 per cent. $AuSn$ is a hard, brittle alloy, silver-grey in colour; it is as resistant as pure gold to the action of acids. $AuSn_2$ is also silver-grey in colour and its colour is unchanged by nitric acid; $AuSn_4$ on the other hand is turned a golden brown by nitric acid. If alloys of gold and tin are treated with aqua regia, purple of Cassius results.

Gold-Bismuth Alloys. Bismuth affects the ductility of gold more than any other metal; as little as 0·25 part of bismuth in 1,000 parts of fine gold will make the metal so fragile that it breaks under the hammer.

Gold-Lead Alloys. Alloys of gold and lead are readily fusible and very brittle: they range in colour from yellowish grey to bluish white. The lead can be dissolved out of them with nitric acid, but is more readily separated by exposing the molten alloy to a current of air at red heat, whereby the lead is oxidized to litharge which can be removed by absorption in some porous substance such as bone-ash or allowed to flow away through shallow channels in the furnace bed, the molten metal being held together by its higher surface tension. As the molten litharge dissolves and carries away the oxides of other metals which are not readily fusible alone this method known as cupellation is used in refining and assaying; gold containing base metal impurities being melted down with excess of lead and then subjected to cupellation. While almost the last traces of lead can be removed in this way, silver, platinum, and some other metals will, if present, remain with the gold. The art of cupellation is of great antiquity, being known to the ancient Hebrews.

Gold-Iron Alloys. Gold and iron unite in all proportions to form alloys which are hard, but malleable and ductile so long as not more than 80 per cent of iron is present. The alloys containing 8 to 10 per cent iron are pale yellow in colour, very ductile, and capable of high polish. Those containing 15 to 20 per cent iron are greyish yellow and very hard, but easily worked; they are used in jewellery in France under the name *or gris*. The alloy with 25 per cent iron is employed by jewellers under the name *or bleu*. Those containing 75 to 80 per cent iron are silver-white, are extremely hard, and are attracted by the magnet.

Gold-Nickel Alloys. Small quantities of nickel alloyed with gold furnish pale yellow, hard, very ductile alloys which take a good polish. Also they are magnetic. Larger amounts of nickel completely mask the colour of gold.

Gold-Platinum Alloys. When platinum is added to gold the yellow colour of the latter rapidly disappears, only a faint tinge remaining when platinum forms 30 per cent of the alloy; with 40 per cent or over the colour is that of platinum. The alloy containing 10 per cent of gold and 90 of platinum has a brilliant white crystalline structure; that containing 25 per cent gold and 75 platinum is hard and brittle, resembling grey cast iron.

Gold-Aluminium Alloys. Gold alloyed with 6·4 per cent aluminium is a hard white substance; alloyed with 21·5 per cent aluminium it takes on a beautiful purple colour.

RARITY OF GOLD

Gold in minute quantities is found widely distributed both in solid rock deposits and as a minor constituent of some gravels. It forms, however, but a very small part of the earth's crust and is seldom found concentrated in deposits that are rich enough and at the same time large enough to be worked at a profit. At the present time approximately 70 per cent of the world's annual production of gold comes from four countries, viz., Union of South Africa, Russia, Canada, and the United States. The following table shows the relative abundance of gold as compared with some of the commoner metals.

Relative Natural Abundance of Metals

Metal	Percentage in earth's crust	Natural abundance, Gold=1
Gold	0·0000005	1
Silver	0·00001	20
Lead	0·0020	4,000
Zinc	0·0040	8,000
Copper	0·0075	15,000
Iron	4·44	8,800,000

The world's entire production of gold from the discovery of America in 1492 to the end of 1933 could be cast into a cube of which the edge would measure, approximately, only 40·136 feet.

The efficiency that has been attained in the extraction of gold from its ores is illustrated by the fact that at Juneau, in Alaska, ore carrying on the average about 80 cents, or less than 1 dwt. of gold a ton has been worked at a profit. Gold-bearing gravels containing as little as $\frac{1}{8}$ dwt. gold a ton have, under favourable conditions, been dredged with profit. One pennyweight (approximately $1) of gold to the ton of 2,000 pounds represents only 1 part in 583,333 by weight, or, in ordinary gold ores, about 1 part in 3,500,000 by volume. At the Howey mine in Ontario, probably the lowest cost gold mine in Canada at the present time, ore carrying in the neighbourhood of 1·25 dwt. can be mined and milled at an operating profit. [1]

Gold, in amounts far below the present limits of profitable extraction, is said to occur in all ores of silver, copper, lead, antimony, and bismuth; in rocks of all ages and types; and in sea-water. It has been estimated that the total quantity of gold contained in sea-water amounts to nearly $50,000,000 (gold at $20.67 an ounce) for each inhabitant of the globe.[2]

MODES OF OCCURRENCE OF, AND METHODS OF WINNING GOLD

Placers

Gold is for the most part found in nature in the "native" or metallic state alloyed with varying amounts of metallic impurities, chiefly silver. The only natural compound of gold known with certainty to exist is the telluride, which accompanies native gold in some deposits, those at Kirkland Lake, Ontario, for example. Native gold virtually always contains more or less silver and as the chemical properties of the two metals are in many respects similar, both are recovered together in the principal processes used for extracting gold from its ores. In addition to silver, native gold often contains also small amounts of base metal impurities such as copper, iron, lead, etc.

What are known as "placer" deposits are merely sand and gravel deposits of which native gold, in the form of scales, grains, and lumps ("gold dust" and "nuggets"), is one of the constituents. Gold as found in placers ranges from minute particles so small as to be irrecoverable by any known economical method up to masses of considerable size, the largest recorded being the "Welcome" nugget found at Ballarat, Australia, in 1858, which contained 2,019$\frac{3}{4}$ ounces of gold and was valued at £8,376 10s 10d. One found in California weighed 280 ounces; and one from Klondike, 85 ounces. Most of the gold recovered from placers, however, is in the form of grains and "dust."

Placers being simply surface accumulations of, usually, water-borne detritus resulting from the weathering of auriferous rocks, they are as a rule comparatively easily found; and as the gold they contain has already been entirely, or almost entirely, freed from adhering rock-matter by the disintegrating influences of atmospheric agencies, its further complete separation from the accompanying worthless material is a simple operation. If the mixture of earth, sand, and gravel containing particles of gold is shovelled into a trough, or sluice box, containing a stream of running water, the gold by reason of its great weight settles to the bottom and may be caught and retained in pockets or behind projecting "riffles"—miniature submerged dams—suitably placed in the bottom of the sluice, while the lighter, worthless sand and gravel is carried away by the current. The troughs, or sluice boxes, are built of wood and are of simple crude construction; the "riffles" are simply cleats of wood fastened to the bottom of the sluice. In practice, mercury is usually placed in the sluice box in order to facilitate the recovery of the gold. Mercury being very heavy sinks through the moving mixture of sand, gravel, and water, amalgamates with any gold it meets on the way and is finally caught in the traps, or pockets, or behind the riffles even more effectively than unamalgamated gold, on account of its greater bulk. As a further precaution against the escape of fine gold, the material remaining after all coarse gravel and boulders have been removed by suitably placed screens is often passed in a thin stream over amalgamated copper plates before being sent to waste.

---

[1] Can. Min. Jour., October, 1934, p. 443.

[2] Rose, T. K.: "The Precious Metals," Archibald Constable & Co., Ltd., London, 1909, pp. 68-69.

In hydraulicking, the gold-bearing gravels are washed out of the bank into the sluice boxes by powerful jets of water; in dredging, a mechanical excavator scoops up the auriferous ground in front of it, passes it through washing and amalgamating apparatus, and discharges the barren material at the rear. Both hydraulicking and dredging, where conditions are favourable for their employment, are extremely cheap methods of moving large quantities of unconsolidated material, hence, by their means many placers too low in gold to pay if the material were shovelled into sluice boxes by hand can be profitably exploited.

Placers, being by their nature easily found and easily worked, are usually the first deposits to be exploited in gold-producing countries and the first to be exhausted. Between 1848 and 1875, probably 90 per cent of the world's gold production was derived from placers; at the present time, in spite of greatly increased total production, probably less than 10 per cent is so obtained.

Lode Gold Deposits

In hard-rock, or lode, deposits (including under this term such deposits as those of the Witwatersrand in South Africa which, though probably originally placers, are exploited entirely by lode-mining methods) the gold usually occurs in the metallic or "native" state, just as it does in placers, but lode gold, unlike placer gold, is still firmly embedded in solid rock matter, often quartz, but also in a great variety of other rock-forming materials. Moreover, though gold may occur in a vein, or lode, in grains, scales, or threads large enough to be readily seen with the naked eye, most of it occurs in minute particles that only become visible when viewed through a powerful microscope. A very rich piece of gold ore may show no visible gold whatever. On the other hand, scattered showings of visible gold do not necessarily indicate a workable deposit.

It follows from what has been said, that preliminary to actual extraction of lode gold from its ore, the latter must be broken out of solid rock, usually in underground excavations and then crushed fine enough either to free the enclosed gold particles from rock matter or at least to expose them so that they can be acted upon by solvents, rather costly operations that have already been done by nature in the case of placers. Furthermore, the often extremely minute subdivision of the gold contained in lodes, its often extremely intimate association with the associated gangue, or its occasional occurrence in the form of tellurides, render the simple processes alone necessary for the extraction of placer gold entirely unsuited to the extraction of much of the gold found in lodes.

The chief methods used for the recovery of gold from its ores are:

Smelting, which is often used when the gold is intimately associated with base metal sulphides, or when the ore to be treated is very "refractory," i.e. does not readily yield to treatment by other methods. In this method, the ore with or without previous concentration is added to the charge of a copper or lead furnace and the gold separated from the base metal during the process of refining the latter. It is a comparatively unimportant method except for ores in which the precious metals are accompanied by large quantities of copper or lead.

Washing, in which the finely crushed ore is carried by a thin stream of water over blankets or cloth having a rough surface. The nap on the cloth serves the same purpose as the riffles in the placer miner's sluice box, that is it catches and holds the gold and other heavy minerals which sink to the bottom while the lighter waste material is carried off by the water. The blankets are taken up periodically and shaken in a tub of water to free them from the entangled rich gold concentrate, which sinks to the bottom of the tub; the concentrate is collected and then treated with mercury for the separation of the gold by amalgamation.

When an ore contains considerable amounts of coarse gold, the mixed stream of water and crushed ore is sometimes passed through a trap or pocket in which the larger pieces of gold are caught and held either by their own weight or by mercury.

Amalgamation. In this method the gold is brought into contact with mercury, with which, when clean, it unites readily to form an "amalgam"—a solution of gold in mercury—which by reason of its bulk and weight can be readily separated from the barren gangue minerals. The amalgam is collected, strained through chamois or close-woven canvas which retains the richer amalgam but allows most of the mercury to pass through. The strained amalgam is then placed in a retort, the remaining mercury driven off by heat, and the residual "sponge" of gold melted down into bullion.

A common method of bringing the gold into contact with mercury is to pass the crushed ore mixed with water—i.e. the pulp—in a thin stream over copper plates coated with mercury, which catches the gold as it passes over and retains it on the plate. The amalgam as it accumulates on the plate is scraped off from time to time and the plate given a fresh coating of mercury. Often, some mercury is added to the ore in the apparatus used for crushing, before the pulp is passed over the plates.

Chlorination. In the chlorination process the ore is exposed to the action of chlorine gas in tightly closed receptacles; the chlorine acting on the gold to produce chloride of gold. This is then leached out of the mass with water and the gold precipitated from the aqueous solution of chloride of gold by means of a suitable precipitant. This process which was at one time quite extensively used, especially in Australia, is now practically obsolete, having been discarded largely on account of its high cost as compared with the cyanide process and because it does not extract silver along with the gold as is done by all other gold extraction processes in commercial use.

Cyanidation. This process, in which gold (and silver) is dissolved out of the ore by dilute solutions of sodium or potassium cyanide in the presence of air (or oxygen) is now by far the most important method in use.

There are two general ways of applying the cyanide solution to the ore, known respectively as sand leaching and slime treatment. In the first, the ore crushed to a fine sand is placed in large tanks and the cyanide solution allowed to percolate slowly through it, the solution being run, intermittently, in batches with periods of aeration between. In the second, the ore ground extremely fine, like slime, is agitated—in order to supply the necessary air—with the cyanide solution in vats or some form of special apparatus. After the gold has been dissolved the solution is separated from the now barren pulp by settling, filtering, and washing, and the gold precipitated from it in the form of a fine mud, by the addition of, usually, zinc dust. The precipitated gold is in turn filtered off from the barren solution, washed, dried, and melted down with suitable fluxes to bullion.

The sand-leaching process is a slow one as many hours of contact must be allowed for the dissolving of the gold; also it is intermittent. The sliming method, on the other hand, is a more continuous operation and the ore being ground very much finer, solution of the gold takes place much more rapidly—the finer the ore is ground the quicker and more complete being the extraction. For these reasons the trend has been away from sand-leaching methods in spite of the increased cost of fine-grinding involved in sliming. In few, if any, Canadian cyanide plants is sand leaching employed, though it was the only method used when cyanidation was first introduced and is still largely used in South Africa.

In practice, two or more methods of extraction are often employed in combination in the treatment of gold ore. If, for example, the ore contains coarse as well as very fine gold, the former may be saved by passing the pulp over blankets and the latter by subsequent cyanidation, as is done at the Dome mine in Ontario. Or, if some of the gold is intimately associated with sulphides while the rest is "free," the free gold may be recovered by amalgamation and the sulphides then separated out by some method of concentration, the concentrate being either cyanided or sent to a smelter. Gold intimately associated with sulphides is not amenable to amalgamation but is dissolved by cyanide solution. On the other hand the action of cyanide being slow as compared with that of mercury, amalgamation or washing or a combination of the two is better suited to the recovery of coarse gold than is cyanidation.

HISTORY OF GOLD

Gold, owing to its widespread occurrence in placers, was probably the first metal with which man became acquainted. Its colour and lustre in striking contrast with the ordinary dull pebbles of the gravel of a stream bed can hardly have failed to attract the eye of primitive man. His curiosity thus aroused, the weight of this peculiar material, so much greater than that of any other with which he was acquainted, would next be noticed. Carrying his experiments further he would soon learn that this strange substance could also be hammered into any shape his fancy suggested; and though too soft to be particularly useful when fashioned into weapons or tools, that it lost none of its original attractive colour and lustre through time and use. Thus gold became, first, an ornament valued everywhere for its indestructible beauty and for its rarity. Later, as an object of universal desire, it would become a common object of barter—for which purpose also a number of its physical characteristics rendered it specially adaptable. It could be identified with ease and certainty by its colour, lustre, and weight; it could be readily sub-divided when necessary by reason of its sectility; and its great weight as compared with its bulk made its transportation easy. Its weight as compared with its bulk also made the secretion of gold in quantities representing great value an easy matter, and thus, not only rendered its transportation safer than that of most other commodities, but also made it an especially suitable material to serve as an unchanging store of hidden wealth reserved for future needs. "It may be taken for granted, from the record of antiquity, that gold possessed a distinct value in prehistoric times, measureable by other commodities, and that this appreciation was maintained owing to the travel of the metal far from the place of origin, and to the purpose to which it was almost universally applied, namely, the adornment of the person."[1] Gold appears to have become a standard of value in Egypt at least 5,500 years ago; for in the code of Menes of about 3600 B.C. one part of gold is declared equal in value to two and a half of silver.

As the desire of possessing bits of gold became recognized among primitive peoples the wearing of gold ornaments became a sign of chieftainship and a prerogative of the powerful and thus gradually became linked with the idea of divinity—with priest and king, regarded as the representatives on earth of divine authority. The ancient Egyptians, to indicate the sacred character of gold represented it by a circle with a dot in the centre, the circle being a symbol of divinity and perfection; and in the decoration of temples and palaces gold was largely used in ancient times. We are told that the temple of Solomon was profusely adorned with gold; the wall of the Holy of Holies being overlaid with gold; and that many accessories such as lamps and hinges were made entirely of gold. The flood of gold that was poured into Spain by the Conquistadores was chiefly loot from the temples and palaces of the ancient civilizations of Central and South America.

The earliest known gold coins were made not of pure gold but of electrum, a natural mixture of gold and silver containing approximately one-fifth of the latter. Globules of this metal carrying a variety of stamps and dating from the eighth century B.C. have been found at Ephesus. The first regular struck coinage appears to have been that of Lydia of about 700 B.C. This consisted of bean-shaped pieces of metal, containing about 73 per cent gold and 27 per cent silver, bearing stamps on one side and the marks of the anvil on the other. In the middle of the fourth century B.C. a regular gold currency was set up in European Greece by Philip II of Macedonia. This became later the gold currency of Rome and was imitated by the Gauls, Britons, and other barbarians. Crude gold coins were in use in Britain before the Roman invasion and a few were also struck during the Saxon period. For the five hundred years between the eighth and thirteenth centuries A.D., however, the denier, or silver penny, was practically the only coin in use in Europe. The earliest English gold coin was the gold penny struck by Henry III in 1257, which had a current value equal to that of 20 (later 24) silver pennies of the day. The issue was, however, unsuccessful and it was not till the reign of Edward III that English gold coinage became finally established on a secure basis, in 1351, when the noble, weighing 120 grains and valued at 6s. 8d, was issued. The first sovereign, a large coin weighing 240 grains, was issued by Henry VII; but modern English coinage dates only from the reign of Charles II, when, in 1662, the guinea was issued. With its multiples, the two-guinea and five-guinea pieces, the guinea remained the standard English coin till the recoinage of 1816 when it reappeared as the sovereign.[1] The first Canadian gold coins issued were $5 and $10 gold pieces struck at the Canadian branch of the Royal Mint (now the Royal Canadian Mint) in May, 1912; but gold coins have never been a popular medium of exchange in Canada and the quantity issued has been very small. None has been struck since 1919; most of the fine gold produced at the Mint being delivered to the Department of Finance in the form of bars worth between $10,000 and $11,000 each, the remainder being sold in convenient forms to manufacturers.[2]

---

[1] White, Benjamin: "Gold, Its Place in the Economy of Mankind;" Pitman's Common Commodities and Industries Series; Sir Isaac Pitman & Sons, Ltd., London, Melbourne, and New York, p. 9.

The earliest gold mining centres, of which few traces now remain, were doubtless situated within the boundaries of the oldest civilizations, that is within the valleys of the Nile and the Euphrates. Later, India is said to have been the chief source of the world's gold, and to have continued to supply most of the gold used in Europe up to the discovery of America in 1492. In Europe, the Phoenicians mined gold in Spain; and, later, the Romans in Spain, Gaul, Carinthia, and Transylvania. With the barbarian invasions in the early stages of the dissolution of the Roman Empire, mining in Europe virtually ceased and for centuries Europe was extremely poor in the precious metals. Even during the darkest days of the Middle Ages, however, the washing of gold from the sands of rivers such as the Tiber, Po, Rhine, and Rhone never stopped entirely. Beginning about the thirteenth century and culminating about the time of the discovery of America, there was a distinct revival in European mining, notably in Spain, the Alps, and in Transylvania; and for a century after 1492 over one-fifth of the world's output of gold came from southeastern Europe. From 1493 to 1850 South America was the most important source of gold in the world; during the second half of the nineteenth century, North America and Australasia; and since the beginning of the twentieth century, Africa.

---

[1] "Gold." Times, London, June 20, 1933 (chap. on Gold Coinage).

[2] The Canada Year Book, 1932.

The earliest records of gold mining are in Egypt where pictorial rock carvings, dating back to 2500 B.C., depict the washing of gold from auriferous sands in basins of hollowed stone. Sloping stone tables also were used in very early times and sometimes these or sloping rocks were covered with hides or sheepskins to catch the particles of gold which, being heavy, sank and became entangled in the hair or wool. The legend of Jason and the Golden Fleece was probably based on a free-booting expedition which set out from Phoenicia to despoil the natives of Colchis of gold won by washing auriferous gravels over sheepskins. The winning of gold from deposits in solid rock would naturally come later than the washing of gravels; but according to the writings of Diodorus, the Sicilian, hard-rock mining was well established in Egypt in 59 B.C., and he says that the methods he describes were even at that time very ancient. Workmen under the supervision of hard taskmasters broke down the ore with iron wedges and then crushed it in mortars with iron pestles. It was next ground between stones in mills like corn mills, operated by women and aged men. When reduced to powder, it was spread on slightly inclined tables and a stream of water was directed over it, which washed away most of the waste but left the gold behind. After several washings the last of the waste was picked out by hand and the gold finally melted with a flux and lead in a crucible to purify it.[1] The methods described by Diodorus were probably very widespread, for mortars and tables similar to those used in Egypt have been found in the neighbourhood of ancient gold workings in many other parts of the world.

Probably the first great advance in the primitive metallurgy of gold was the employment of mercury as an aid in separating it from accompanying waste rock. Just when this was first done is not known, but the use of mercury for this purpose is mentioned by writers at the beginning of the Christian era. During the Middle Ages there are few references to the use of mercury in the metallurgy of gold; though one writer in the eighth century mentions it in this connexion and another in the eleventh describes its use in extracting gold from the sands of the Rhine. In the Tyrol, an amalgamation process of extremely ancient origin consisting of stirring crushed ore mixed with water and mercury in circular bowls and then separating the gold from the resulting amalgam was in vogue for centuries, and even in modern times amalgamating machines operating on the same principal were in use in Hungary. The use of copper plates for catching amalgam probably first came into use in the seventeenth century.

Contrivances in which crushing and amalgamation were effected in one operation appear in the sixteenth century; one of the earliest being the arrastre, introduced into America for the treatment of gold ores about 1557, and in its modern forms, a piece of apparatus still occasionally found useful in working small rich deposits in localities difficult of access. At its crudest, the arrastre consisted of a shallow, circular, flat bottomed pit tightly paved with hard stones, in the centre of which was set an upright shaft carrying several horizontal arms. To each arm a heavy stone was attached by thongs or chains in such a way that one end of the stone was raised a little from the floor of the pit while the other rested on it. The ore together with water and mercury was placed on the floor of the pit and horses or mules hitched to the ends of the arms and driven round and round outside the pit, or a water-wheel connected by suitable gearing to the central vertical shaft caused the latter to rotate and drag the stones attached to the arms over the pavement in a circular path, thus crushing the ore and at the same time thoroughly mixing the mercury with the crushed material. When the ore had been ground fine enough to free all the gold so that it could amalgamate with the mercury, water was turned into the pit to wash away the barren rock after which the mercury and amalgam left on the floor was collected and retorted to obtain the gold.

---

[1] Man and Metals, vol. I, pp. 209-212.

Stamp-batteries for the crushing of gold ores first appear to have been used in Germany—about the beginning of the sixteenth century; previous to that hand-mortars, grinding-mills of various kinds, and sieves appear to have been the only apparatus used in dressing gold ores. The first stamps were crude affairs, consisting of wooden stems shod with hard stones or with lumps of iron. They were usually arranged in sets of three to a battery and were driven by water-wheels. The closed mortar-box having screens for its sides so that crushing and screening went on simultaneously—one of the first notable advances in stamp-mill practice—though it was known in 1556 or earlier, had not come into general use even by the middle of the seventeenth century. The use of amalgamated plates in connexion with stamp-batteries is a modern device of which there is no mention up to about 1850, when plates inside the mortar-box were introduced in California in gold-milling practice. Previous to that it was customary to pass the pulp from the stamp-batteries over tables covered with blankets, which caught the gold in much the same way that Jason had seen it caught on sheepskins in Asia Minor in 1200 B.C. About 1860, blankets began to be replaced by amalgamated copper plates and the use of plates outside the battery became almost universal soon after 1870.

The first process in which gold was extracted from its ores as a chemical compound in aqueous solution—from which it was subsequently recovered by precipitation—was the chlorination process introduced in 1848. This process, which has now been almost or entirely superseded by the cyanide process, was at one time quite extensively used, notably in Australia. It was an intermittent process especially adapted to the treatment of small batches of rich auriferous concentrate, but costly as compared with cyanide treatment.

Patents covering the extraction of gold by means of aqueous solutions of the alkali metals, probably the most important development in the history of the metallurgy of gold, were taken out in Great Britain in 1840 and in United States in 1867; but the possibilities of the method were not realized until after 1890. In that year the cyanide process was tried in South Africa, where previously it had been found impossible to recover more than 55 or 65 per cent of the gold in the Rand ores by amalgamation and only small additional amounts by subsequent concentration and chlorination. Its introduction was attended with such immediate and striking success that its use soon spread to all parts of the world where gold was being mined. To-day it is much the most important method used for the extraction of gold from its ores; and were it not for the cyanide process it would be impossible for most of the world's largest gold mines to be worked at a profit.

ERAS OF WORLD GOLD PRODUCTION

The long time trend of a curve representing world gold production would be upward, with minor ups and downs that, until quite recently, corresponded with the discovery of new goldfields and their subsequent depletion rather than with changes in the world's demand for gold, i.e. with changing rates of increase in population and periods of business activity and depression. The present upward swing in the production curve, on the contrary, is due directly to an insistent demand for gold created by conditions arising from the World War rather than from the discovery of notable new goldfields; and moreover is taking place during a period of depression and business stagnation when the demand for gold would normally be less than usual.

Of the magnitude of the world's output of gold previous to the discovery of America we know little; but in all likelihood it was very small as compared with that of later times. The first great era of gold production of which we have actual record—and probably the greatest the world had ever seen up to that time—was the period immediately following 1492, when the loot of palaces and temples and the produce of mines exploited by slave labour in Central and South America poured into Spain in a flood of gold that for a time unbalanced the economic structure and unsettled the political control of Europe. The next period of greatly accelerated gold production followed the discovery of marvellously rich placers in California and Australia; when, in the twenty-five years between 1850 and 1875, it is estimated, the world produced more gold than in the 358 years immediately preceding. A third period began about 1890, when the successful application of the cyanide process to the ores of the Rand made economically available the world's largest-known deposit of gold. During this period other important discoveries were made also in Yukon, Alaska, Nevada, and Colorado, resulting in the peak of annual world production up to that time—22,718,154 ounces—being reached in 1915. By 1922 the output had dropped back to 15,467,223 ounces, following which there was a gradual increase, due chiefly to increasing production in South Africa and Canada, until in 1932 the old peak of 1915 was passed. The large increase in the price of gold since Great Britain went off the gold standard in September, 1931, and the United States in April, 1933, has resulted in a fourth period of intensified world gold production the culmination of which has yet to come; the estimated output of 1934—the largest ever recorded—being 27,339,233 ounces or about 17 per cent higher than that of 1915.

The following graph and table indicate the relative importance of the gold production of the different countries of the world at the present time.

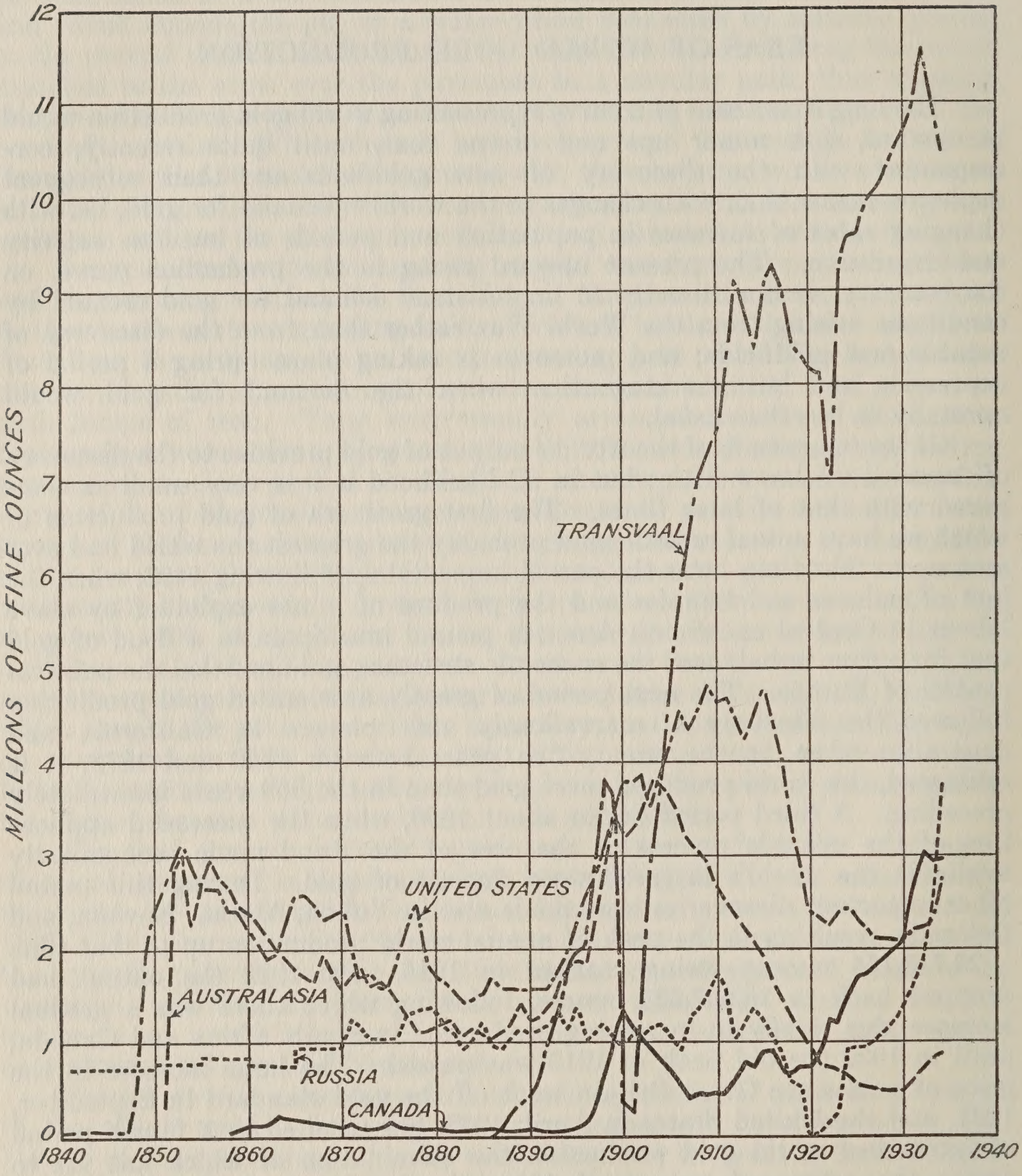

Figure 1. Production of gold in the main producing countries, 1840 to 1934.

TABLE I

World Production of Gold*

(The production figures given below are based upon the unpublished data, principally interrogatory replies, in the files of the Bureau of the U.S. Mint)

Country	Calendar year 1932			Calendar year 1933—Subject to revision		
	Gold			Gold		
	Kilos, fine	Ounces, fine	Value[1]	Kilos, fine	Ounces, fine	Value[1]
NORTH AMERICA—						
United States	69,030	2,219,304	$45,877,085	70,815	2,276,711	$47,063,800
Canada	94,886	3,050,581	63,061,106	91,736	2,949,309	60,967,614
Mexico	18,180	584,487	12,082,419	19,836	637,727	13,182,984
Total	182,096	5,854,372	121,020,610	182,387	5,863,747	121,214,398
Central America and West Indies[2]	2,558	82,238	1,700,000	2,708	87,075	1,800,000
SOUTH AMERICA—						
Argentina	30	964	19,928	(4) 30	964	19,928
Bolivia	382	12,281	253,871	(4) 382	12,281	253,871
Brazil	(4) 3,591	115,451	2,386,584	3,919	126,000	2,604,650
Chile	1,185	38,098	787,555	4,526	145,511	3,007,979
Colombia	7,721	248,230	5,131,368	9,277	298,246	6,165,208
Ecuador	2,041	65,629	1,356,671	1,887	60,667	1,254,098
Guiana—						
British	582	18,714	386,853	966	31,056	641,986
Dutch (Surinam)	279	8,970	185,426	385	12,378	255,876
French	(3) 1,400	45,010	930,439	1,321	42,456	877,649
Peru	1,728	55,555	1,148,424	2,615	84,072	1,737,922
Uruguay	....	....	....	....	18	383
Venezuela	2,398	77,087	1,593,529	2,977	95,710	1,978,501
Total	21,337	685,981	14,180,648	28,285	909,359	18,798,051
EUROPE—						
Austria	8	257	5,313	....	....	....
Czechoslovakia	71	2,283	47,194	(4) 71	2,283	47,194
France	(3) 1,350	43,402	897,199	1,800	57,870	1,196,279
Germany	68	2,186	45,189	(4) 68	2,186	45,189
Great Britain	....	6	124	2	64	1,323
Greece	(3) 15	482	9,964	(3) 15	482	9,964
Hungary	....	....	....	89	2,861	59,142
Italy	57	1,832	37,871	80	2,565	53,021
Norway	....	....	....	....	....	....
Poland	....	....	....	....	....	....
Rumania	3,410	109,631	2,266,273	3,732	120,000	2,480,620
Russia	61,900	1,990,085	41,138,708	77,430	2,489,375	51,460,000
Spain	15	484	(3) 10,000	353	11,346	234,543
Sweden	(4) 2,800	90,000	1,860,465	4,228	135,930	2,809,922
Jugoslavia	1,480	47,582	983,607	2,188	70,344	1,454,139
Total	71,174	2,288,230	47,301,907	90,056	2,895,306	59,851,336
ASIA—						
British India	10,253	329,632	6,814,098	10,454	336,106	6,947,926
China	3,009	96,751	2,000,000	4,666	150,000	3,100,774
Chosen (Korea)	6,489	208,626	(4)4,312,683	(3) 6,489	208,626	4,312,683
Federated Malay States	845	27,159	561,426	903	29,036	600,227
Indo China	(4) 9	289	5,974	5	161	3,328
Japan	13,500	434,037	(4)8,972,347	13,493	433,800	8,967,440
Netherlands East Indies	2,425	77,964	1,611,659	2,452	78,832	1,629,602
Philippine Islands	7,146	229,728	4,748,899	8,695	279,535	5,778,500

TABLE I—Conc.

World Production of Gold*

(The production figures given below are based upon the unpublished data, principally interrogatory replies, in the files of the Bureau of the U.S. Mint)

Country	Calendar year 1932			Calendar year 1933—Subject to revision		
	Gold			Gold		
	Kilos, fine	Ounces, fine	Value[1]	Kilos, fine	Ounces, fine	Value[1]
ASIA—Conc.						
Sarawak	254	8,178	169,054	582	18,712	386,811
Taiwan	2,875	92,430	(4)1,910,694	(3) 2,875	92,430	1,910,694
Turkey[3]	28	900	18,605	...	...	...
Total	46,833	1,505,694	31,125,439	50,614	1,627,238	33,637,985
OCEANIA—						
Australia—						
New South Wales	869	27,941	577,592	910	29,252	604,692
Northern Territory	13	421	8,703	20	659	13,623
Queensland	724	23,263	480,889	2,861	91,977	1,901,333
South Australia	94	3,014	62,305	82	2,648	54,739
Victoria	1,485	47,745	986,976	1,810	58,183	1,202,749
West Australia	18,836	605,561	12,518,057	19,820	637,208	13,172,255
Fiji	9	305	6,305	9	(3) 305	6,305
Tasmania	185	5,937	122,729	208	6,673	137,943
New Guinea (Australian mandate)	3,379	108,647	2,245,933	4,784	153,820	3,179,741
Papua	310	9,981	206,325	311	9,991	206,532
New Zealand	5,146	165,452	3,420,196	5,031	161,755	3,343,772
Total	31,050	998,267	20,636,010	35,846	1,152,471	23,823,684
AFRICA—						
Algeria	...	...	...	...	...	...
Belgian Congo	7,549	242,691	5,016,867	8,776	282,144	5,832,440
Bechuanaland	70	2,250	46,512	172	5,525	114,212
British West Africa (Gold Coast, Ashanti, Nigeria, Sierra Leone)	9,098	292,510	6,046,718	10,517	338,110	6,989,352
Egypt	...	14	289	...	...	...
Eritrea	59	1,897	39,214	111	3,569	73,778
Ethiopia (Abyssinia)	125	(3) 4,000	82,687	30	964	19,928
French Equatorial Africa	(3) 60	1,929	39,876	780	25,077	518,387
French West Africa	150	4,837	(3) 100,000	1,500	48,225	996,899
Kenya Colony	282	9,052	187,121	328	10,532	217,716
Madagascar	(4) 227	7,298	150,863	416	13,374	276,465
Portuguese East Africa	88	2,829	58,481	53	1,705	35,245
Rhodesia—						
Northern	198	6,349	131,245	80	2,588	53,499
Southern	17,858	574,135	11,868,424	19,984	642,499	13,281,630
Southwest Africa	25	807	16,673	42	1,338	27,651
Swaziland	11	365	7,545	29	921	19,047
Sudan	25	797	16,475	137	4,412	91,204
Tanganyika	799	25,687	530,997	1,011	32,516	672,165
Transvaal, Cape Colony, and Natal	359,519	11,558,532	238,936,062	342,573	11,013,713	227,673,603
Total	396,143	12,735,979	263,276,049	386,539	12,427,212	256,893,221
Total for world	751,191	24,150,761	499,240,663	776,435	24,962,408	516,018,675

---

* From Ann. Rept. of the Director of U.S. Mint, 1934.

[1] Average price per fine ounce in New York.

[2] Estimate based on United States imports of ore and bullion and interrogatory data.

[3] Estimate based on other years' production.

[4] Last year's figures.

CHAPTER II

GOLD MINING IN CANADA

HISTORICAL

Placer gold is said to have been found in the valley of the Chaudiere river in the province of Quebec as early as 1823 or 1824, but no systematic attempt was made to work it until nearly 25 years later. Following the world-wide excitement caused by the famous discoveries in California in 1848 and in Australia in 1851, important gold discoveries of placer gold were made in British Columbia in 1858, and of lode deposits in Nova Scotia in 1862. Up to 1895, the greater part of the gold produced in Canada was from British Columbia placers, though there was also a substantial production from Nova Scotia lode mines during this period, and the Chaudiere placers, in Quebec, are estimated to have yielded about $2,000,000 in gold between 1860 and 1876.

In 1896, the discovery of rich gravels on the Klondike river in Yukon was the beginning of a second period of intensive gold production in Canada; when between 1898 and 1905, gold to the value of more than $100,000,000 (4,838,000 fine ounces) is said to have been obtained from placers on Bonanza, Eldorado, Hunker, Dominion, and Sulphur creeks. During this period also the rich copper-gold deposits of Rossland and adjoining districts in southern British Columbia were opened up and exploited, marking the beginning of lode-gold mining in that province; there was also a revival of activity in gold mining in Nova Scotia; and considerable excitement was caused in Ontario by discoveries in the Lake of the Woods district, though in this last case comparatively little actual production resulted. The peak of prosperity during this second period was reached in 1900, when Canada's gold output reached 1,350,057 fine ounces, the largest annual output recorded up to that time. Between 1900 and 1907, production gradually but steadily decreased to 405,517 ounces in 1907.

With the discovery of the Porcupine gold camp in 1909, followed by that at Kirkland Lake in 1912, Canada entered on its third important period of gold-mining activity, the effect of the Porcupine discoveries on production figures first becoming markedly evident in 1912. The remarkable success that attended the development of the Porcupine and Kirkland Lake camps led to intensive search for gold not only in other parts of Ontario but also in the adjoining provinces of Quebec and Manitoba. In 1924, discoveries were made at Rouyn that have now made Quebec the second largest producer of gold in the Dominion; others made at various points in Manitoba since 1911 have transformed that formerly almost purely agricultural province into one of Canada's more important mining areas. In British Columbia also during this period the famous Premier mine, which between 1919 and 1934 produced 1,370,440 ounces of gold, was brought into production and reached its zenith, to be followed by the equally famous Pioneer mine, now the largest gold producer in the province.

The beginning of the fourth, and most important period of gold production in Canada, may be dated from 1931, when Great Britain went off the gold standard. Since then the increased price of gold has caused unprecedented activity, not only in producing mines, but also in the search for and development of new deposits, and in the investigation of old prospects and former producers, of which the possibilities of being worked at a profit are now much greater than when the price of gold was $20.67. Though the intense activity now in evidence has, so far, found expression in increased value rather than in increased volume of production, it seems safe to say that the latter also will soon surpass all previous records.

TABLE II

Estimated Average Monthly Value of an Ounce of Fine Gold Expressed in Canadian Funds

—	1931	1932	1933	1934
January	20·71	24·24	23·64	33·05
February	20·67	23·67	24·74	35·29
March	20·67	23·11	24·78	35·08
April	20·68	22·98	25·33	34·93
May	20·68	23·38	27·75	34·94
June	20·73	23·83	28·24	34·73
July	20·74	23·73	30·58	34·59
August	20·73	23·61	30·09	34·19
September	21·55	22·88	31·79	34·18
October	23·22	22·65	31·48	34·27
November	23·22	23·73	32·68	34·16
December	25·01	23·85	32·14	34·57
Yearly Average	21·55	23·47	28·60	34·50

Of the total recorded production of gold in Canada from 1858 to the end of 1934 nearly 73 per cent has been won since 1909. The Porcupine and Kirkland Lake camps in Ontario have been by far the most important producers; their combined output to the end of 1934 amounting, approximately, to 26,355,000 fine ounces equivalent to over 53·0 per cent of the total recorded production of the Dominion, or to about 73·6 per cent of its production since 1909. In 1934, they produced 1,938,739 ounces, or about 65·0 per cent of Canada's gold production for that year.

TABLE III

Production of Gold in Canada, 1858-1934

Year	Canada		British Columbia		Nova Scotia		Quebec		Yukon		Ontario		Alberta		Manitoba		Saskatchewan		Year
	Fine ounces**	Value	Fine ounces**	Value	Fine oz.**	Value	Fine ounces**	Value	Fine ounces**	Value	Fine ounces**	Value	Fine ounces**	Value	Fine ounces**	Value	Fine ounces**	Value	
		$		$		$		$		$		$		$		$		$	
1858....	34,104	705,000	34,104	705,000	......	....	......	......	......	......	......	......	......	......	......	......	......	......	1858
1859....	78,129	1,615,072	78,129	1,615,072	......	....	......	......	......	......	......	......	......	......	......	......	......	......	1859
1860....	107,806	2,228,543	107,806	2,228,543	......	....	......	......	......	......	......	......	......	......	......	......	......	......	1860
1861....	128,973	2,666,118	128,973	2,666,118	......	....	......	......	......	......	......	......	......	......	......	......	......	......	1861
1862....	135,391	2,798,774	128,528	2,656,903	6,863	141,871	......	......	......	......	......	......	......	......	......	......	......	......	1862
1863....	202,498	4,186,011	189,318	3,913,563	13,180	272,448	......	......	......	......	......	......	......	......	......	......	......	......	1863
1864....	199,605	4,126,199	180,722	3,735,850	18,883	390,349	......	......	......	......	......	......	......	......	......	......	......	......	1864
1865....	192,898	3,987,562	168,887	3,491,205	24,011	496,357	......	......	......	......	......	......	......	......	......	......	......	......	1865
1866....	152,555	3,153,597	128,779	2,662,106	23,776	491,491	......	......	......	......	......	......	......	......	......	......	......	......	1866
1867....	145,775	3,013,431	120,012	2,480,868	25,763	532,563	......	......	......	......	......	......	......	......	......	......	......	......	1867
1868....	134,169	2,773,527	114,792	2,372,972	19,377	400,555	......	......	......	......	......	......	......	......	......	......	......	......	1868
1869....	102,720	2,123,405	85,865	1,774,978	16,855	348,427	......	......	......	......	......	......	......	......	......	......	......	......	1869
1870....	83,415	1,724,348	64,675	1,336,956	18,740	387,392	......	......	......	......	......	......	......	......	......	......	......	......	1870
1871....	105,187	2,174,412	87,048	1,799,440	18,139	374,972	......	......	......	......	......	......	......	......	......	......	......	......	1871
1872....	90,283	1,866,321	77,931	1,610,972	12,352	255,349	......	......	......	......	......	......	......	......	......	......	......	......	1872
1873....	74,346	1,536,871	63,166	1,305,749	11,180	231,122	......	......	......	......	......	......	......	......	......	......	......	......	1873
1874....	97,856	2,022,862	89,233	1,844,618	8,623	178,244	......	......	......	......	......	......	......	......	......	......	......	......	1874
1875....	130,300	2,693,533	119,724	2,474,904	10,576	218,629	......	......	......	......	......	......	......	......	......	......	......	......	1875
1876....	97,729	2,020,233	86,429	1,786,648	11,300	233,585	......	......	......	......	......	......	......	......	......	......	......	......	1876
1877....	94,304	1,949,444	77,796	1,608,182	15,925	329,205	583	12,057	......	......	......	......	......	......	......	......	......	......	1877
1878....	74,420	1,538,394	61,688	1,275,204	11,864	245,253	868	17,937	......	......	......	......	......	......	......	......	......	......	1878
1879....	76,547	1,582,358	62,407	1,290,058	12,980	268,328	1,160	23,972	......	......	......	......	......	......	......	......	......	......	1879
1880....	63,121	1,304,824	49,044	1,013,827	12,472	257,823	1,605	33,174	......	......	......	......	......	......	......	......	......	......	1880
1881....	63,524	1,313,153	50,636	1,046,737	10,147	209,755	2,741	56,66	......	......	......	......	......	......	......	......	......	......	1881
1882....	60,288	1,246,268	46,154	954,085	13,307	275,090	827	17,093	......	......	......	......	......	......	......	......	......	......	1882
1883....	53,853	1,113,246	38,422	794,252	14,571	301,207	860	17,787	......	......	......	......	......	......	......	......	......	......	1883
1884....	51,202	1,058,439	35,612	736,165	15,168	313,554	422	8,720	......	......	......	......	......	......	......	......	......	......	1884
1885....	55,575	1,148,829	34,527	713,738	20,945	432,971	103	2,120	......	......	......	......	......	......	......	......	......	......	1885
1886....	70,782	1,463,196	43,714	903,651	22,038	455,564	193	3,981	†4,837	100,000	......	......	......	......	......	......	......	......	1886
1887....	57,460	1,187,804	33,558	693,709	20,009	413,631	78	1,604	3,386	70,000	327	6,760	102	2,100	......	......	......	......	1887
1888....	53,145	1,098,610	29,834	616,731	21,137	436,939	181	3,740	1,935	40,000	......	......	58	1,200	......	......	......	......	1888
1889....	62,653	1,295,159	28,489	588,923	24,673	510,029	58	1,207	8,466	175,000	......	......	967	20,000	......	......	......	......	1889
1890....	55,620	1,149,776	23,918	494,436	22,978	474,990	65	1,350	8,466	175,000	......	......	193	4,000	......	......	......	......	1890
1891....	45,018	930,614	20,792	429,811	21,841	451,503	87	1,800	1,953	40,000	97	2,000	266	5,500	......	......	......	......	1891
1892....	43,905	907,601	19,327	399,525	18,865	389,965	628	12,987	4,233	87,500	344	7,118	508	10,506	......	......	......	......	1892
1893....	47,243	976,603	18,360	379,535	18,436	381,095	759	15,696	8,514	176,000	708	14,637	466	9,640	......	......	......	......	1893
1894....	54,600	1,128,688	25,664	530,530	18,834	389,338	1,412	29,196	6,047	125,000	1,917	39,624	726	15,000	......	......	......	......	1894
1895....	100,798	2,083,674	61,289	1,266,954	21,919	453,119	62	1,281	12,094	250,000	3,015	62,320	2,419	50,000	......	......	......	......	1895
1896....	133,262	2,754,774	86,504	1,788,206	23,876	493,568	145	3,000	14,513	300,000	5,563	115,000	2,661	55,000	......	......	......	......	1896
1897....	291,557	6,027,016	131,805	2,724,657	27,195	562,165	44	900	120,937	2,500,000	9,157	189,294	2,419	50,000	......	......	......	......	1897
1898....	666,386	13,775,420	142,215	2,939,852	26,054	538,590	295	6,089	483,750	10,000,000	12,863	265,889	1,209	25,000	......	......	......	......	1898
1899....	1,028,529	21,261,584	203,295	4,202,473	29,876	617,604	238	4,916	774,000	16,000,000	20,394	421,591	726	15,000	......	......	......	......	1899
1900....	1,350,057	27,908,153	228,916	4,732,105	28,955	598,553	......	......	1,077,553	22,275,000	14,391	297,495	242	5,000	......	......	......	......	1900
1901....	1,167,216	24,128,503	257,292	5,318,703	26,459	546,963	145	3,000	870,750	18,000,000	11,844	244,837	726	15,000	......	......	......	......	1901
1902....	1,032,161	21,336,667	288,383	5,961,409	30,348	627,357	391	8,073	701,437	14,500,000	11,118	229,828	484	10,000	......	......	......	......	1902
1903....	911,559	18,843,590	284,108	5,873,036	25,533	527,806	180	3,712	592,594	12,250,000	9,096	188,036	48	1,000	......	......	......	......	1903
1904....	796,374	16,462,517	275,975	5,704,908	10,362	214,209	140	2,900	507,938	10,500,000	1,935	40,000	24	500	......	......	......	......	1904
1905....	684,951	14,159,195	285,529	5,902,402	13,707	283,353	191	3,940	381,001	7,876,000	4,402	91,000	121	2,500	......	......	......	......	1905
1906....	556,415	11,502,120	269,886	5,579,039	12,223	252,676	165	3,412	270,900	5,600,000	3,202	66,193	39	800	......	......	......	......	1906
1907....	405,517	8,382,780	236,216	4,883,020	13,675	282,686	......	......	152,381	3,150,000	3,212	66,398	33	675	......	......	......	......	1907
1908....	476,112	9,842,105	286,858	5,929,880	11,842	244,799	......	......	174,150	3,600,000	3,212	66,398	50	1,037	......	......	......	......	1908
1909....	453,865	9,382,230	250,320	5,174,579	10,193	210,711	193	3,990	191,565	3,960,000	1,569	32,425	25	525	......	......	......	......	1909
1910....	493,707	10,205,835	261,386	5,403,318	7,928	163,891	124	2,565	221,091	4,570,362	3,089	63,849	89	1,850	......	......	......	......	1910
1911....	473,159	9,781,077	238,496	4,930,145	7,781	160,854	613	12,672	224,197	4,634,574	2,062	42,625	10	207	......	......	......	......	1911
1912....	611,885	12,648,794	251,815	5,205,485	4,385	90,638	642	13,270	268,447	5,549,296	86,523	1,788,596	73	1,509	......	......	......	......	1912
1913....	802,973	16,598,923	297,459	6,149,027	2,174	44,935	701	14,491	282,838	5,846,780	219,801	4,543,690	......	......	......	......	......	......	1913
1914....	773,178	15,983,007	252,730	5,224,393	2,904	60,031	1,292	26,708	247,940	5,125,374	268,264	5,545,509	48	992	......	......	......	......	1914
1915....	918,056	18,977,901	273,376	5,651,184	6,636	137,180	1,099	22,720	230,173	4,758,098	406,577	8,404,693	195	4,026	......	......	......	......	1915
1916....	930,492	19,234,976	219,633	4,540,216	4,562	94,305	1,034	21,375	212,700	4,396,900	492,481	10,180,485	82	1,695	......	......	......	......	1916
1917....	738,831	15,272,992	133,742	2,764,693	2,210	45,685	1,511	31,235	177,667	3,672,703	423,261	8,749,581	......	......	440	9,095	......	......	1917
1918....	699,681	14,463,689	180,163	3,724,300	1,176	24,310	1,939	40,083	102,474	2,118,325	411,976	8,516,299	27	558	1,926	39,814	......	......	1918
1919....	766,764	15,850,423	167,252	3,457,406	850	17,571	1,470	30,388	90,705	1,875,039	505,739	10,454,553	24	500	724	14,966	......	......	1919
1920....	765,007	15,814,098	124,808	2,580,010	690	14,263	955	19,742	72,778	1,504,455	564,995	11,679,483	......	......	781	16,145	......	......	1920
1921....	926,329	19,148,920	150,792	3,117,147	439	9,075	635	13,127	65,994	1,364,217	708,213	14,640,062	49	1,013	207	4,279	......	......	1921
1922....	1,263,364	26,116,050	207,370	4,286,718	1,042	21,540	......	......	54,456	1,125,705	1,000,340	20,678,862	......	......	156	3,225	......	......	1922
1923....	1,233,341	25,495,421	200,140	4,137,261	655	13,540	667	13,788	60,144	1,243,287	971,704	20,086,904	......	......	31	641	......	......	1923
1924....	1,525,382	31,532,443	245,719	5,079,462	1,047	21,643	883	18,253	34,825	719,897	1,241,728	25,668,795	......	......	1,180	24,393	......	......	1924
1925....	1,735,735	35,880,826	219,227	4,531,824	1,626	33,612	1,602	33,116	47,817	988,465	1,461,039	30,202,357	......	......	4,424	91,452	......	......	1925
1926....	1,754,228	36,263,110	225,866	4,669,065	1,678	34,687	3,680	76,072	25,601	529,220	1,497,215	30,950,180	......	......	188	3,886	......	......	1926
1927....	1,852,785	38,300,464	183,094	3,784,889	3,151	65,137	8,331	172,217	30,935	639,483	1,627,050	33,634,108	42	868	182	3,762	......	......	1927
1928....	1,890,592	39,082,005	196,617	4,064,434	1,290	26,667	60,006	1,240,434	34,364	710,367	1,578,434	32,629,126	68	1,406	19,813	409,571	......	......	1928
1929....	1,928,308	39,861,663	154,204	3,187,680	2,687	55,545	90,798	1,876,961	35,892	741,954	1,622,267	33,535,234	5	103	22,455	464,186	......	......	1929
1930....	2,102,068	43,453,601	164,331	3,397,023	1,272	26,295	141,747	2,930,170	35,517	734,202	1,736,012	35,886,552	......	......	23,189	479,359	......	......	1930
1931....	2,693,892	55,687,688	160,069	3,308,920	460	9,509	300,075	6,203,101	44,310	915,969	2,085,814	43,117,600	195	4,031	102,969	2,128,558	......	......	1931
1932....	3,044,387	62,933,063	199,004	4,113,778	964	19,928	401,105	8,291,576	40,608	839,442	2,280,105	47,133,952	83	1,716	122,507	2,532,444	11	227	1932
1933....	2,949,309	60,967,626	238,995	4,940,465	1,382	28,568	382,886	7,914,956	39,493	816,392	2,155,519	44,558,531	324	6,698	125,310	2,590,388	5,400	111,628	1933
1934....	2,972,074	61,438,220	296,196	6,122,915	3,525	72,868	390,097	8,064,020	38,798	802,026	2,105,339	43,521,218	393	8,124	132,321	2,735,318	5,405	111,731	1934
‡Total.	49,277,285	1,018,651,972	11,682,179	241,414,839	930,539	19,236,030	1,808,711	37,389,337	9,093,164	187,972,032	25,573,913	528,659,687	16,219	335,275	558,803	11,551,482	10,816	223,586	....Total

---

* From Dominion Bureau of Statistics Reports.

** Calculated from the value $1=0·048375 ounce.

† For the years 1885 and 1886.

‡ Totals subject to revision.

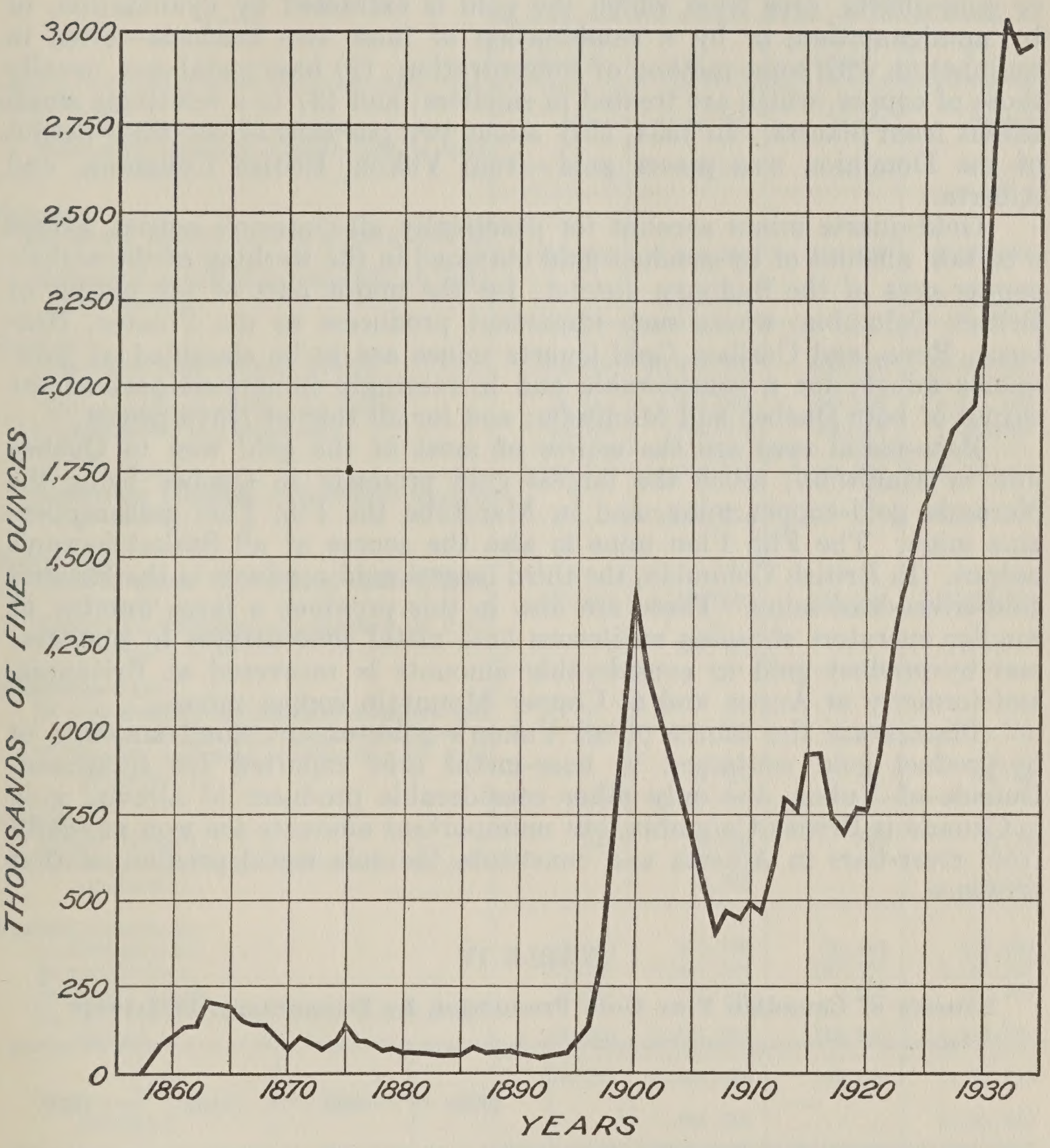

Figure 2. Production of gold in Canada, 1858-1934.

SOURCES OF CANADA'S GOLD

Gold is obtained in Canada from the working of (1) dry and siliceous, or gold-quartz, ores from which the gold is extracted by cyanidation, or by amalgamation, or by a combination of these two methods—often in conjunction with some method of concentration; (2) base metal ores, usually those of copper, which are treated in smelters; and (3) to a relatively small extent from placers. In 1934, only about two per cent of the total output of the Dominion was placer gold—from Yukon, British Columbia, and Alberta.

Gold-quartz mines account for practically all Ontario's output, except a certain amount of by-product gold obtained in the working of the nickel-copper ores of the Sudbury district; for the major part of the output of British Columbia, where such important producers as the Pioneer, Bralorne, Reno, and Cariboo Gold Quartz mines are to be classified as gold-quartz mines; for a considerable and increasingly important part of the output of both Quebec and Manitoba; and for all that of Nova Scotia.

Base-metal ores are the source of most of the gold won in Quebec and in Manitoba; much the largest gold producer in Quebec being the Noranda gold-copper mine, and in Manitoba the Flin Flon gold-copper-zinc mine. The Flin Flon mine is also the source of all Saskatchewan's output. In British Columbia, the third largest gold producer is the Premier gold-silver-lead mine. There are also in this province a large number of smaller operators shipping auriferous base metal concentrates to smelters; and by-product gold in considerable amounts is recovered at Britannia, and formerly at Anyox and at Copper Mountain copper mines.

Placers are the source of all Yukon's gold, except small amounts of by-product gold contained in base-metal ores exported for treatment. Outside of Yukon, the only other considerable producer of alluvial gold in Canada is British Columbia, but unimportant amounts are won annually from river-bars in Alberta and constitute the sole metal product of that province.

TABLE IV

Sources of Canadian Fine Gold Production by Percentages, 1931-1934*

—	1931	1932	1933	1934
	per cent	per cent	per cent	per cent
In alluvial gold	2·1	1·8	2·0	2·0
In crude gold bullion	80·6	79·3	79·8	78·68
In base bullion (from silver-lead ores, etc.)	0·6	1·0	0·7	1·09
In blister copper	13·8	15·1	14·2	13·41
In ore, matte, slags, etc., exported	2·9	2·8	3·3	4·82
	100·00	100·00	100·00	100·00

---

* From Report of Dominion Bureau of Statistics.

TABLE V

Production of New Gold in Canada by Provinces and Sources, 1933 and 1934*

(Gold at $20·671834 per fine ounce)

—	1933		1934	
	Fine troy ounces	$	Fine troy ounces	$
NOVA SCOTIA—				
In gold bullion and ores exported	1,382	28,568	3,525	72,868
Estimated exchange equalization on gold produced	....	10,957	....	48,745
QUEBEC—				
In blister copper, in ores shipped, and in gold bullion	382,866	7,914,956	390,097	8,064,020
Estimated exchange equalization on gold produced	....	3,035,583	....	5,394,327
ONTARIO—				
*Porcupine area—In gold bullion	1,046,091	21,624,620	949,799	19,634,087
*Kirkland Lake—In gold bullion	1,007,036	20,817,281	988,046	20,424,723
*Other gold mines—In gold bullion	65,404	1,352,020	107,120	2,214,367
Copper-nickel and other ores	36,988	764,610	60,374	1,248,041
Total	2,155,519	44,558,531	2,105,339	43,521,218
Estimated exchange equalization on gold produced	....	17,089,312	....	29,112,977
MANITOBA—				
In gold bullion, ores shipped and in blister copper	125,310	2,590,388	132,321	2,735,318
Estimated exchange equalization on gold produced	....	993,478	....	1,829,757
SASKATCHEWAN—				
In ores shipped to Canadian smelters and crude gold to Royal Canadian Mint	5,400	111,628	5,405	111,731
Estimated exchange equalization on gold produced	....	42,812	....	74,741
ALBERTA—				
In alluvial gold	324	6,698	393	8,124
Estimated exchange equalization on gold produced	....	2,569	....	5,434
BRITISH COLUMBIA—				
In alluvial gold	19,142	395,700	20,145	416,434
In gold bullion	122,293	2,528,021	153,173	3,166,367
In blister copper	8,667	179,163	6,063	125,333
In base bullion and in matte and ores exported	88,893	1,837,581	116,815	2,414,781
Total	238,995	4,940,465	296,196	6,122,915
Estimated exchange equalization on gold produced	....	1,894,792	....	4,095,847
YUKON—				
In alluvial gold	39,174	809,798	38,703	800,062
In ores exported	319	6,594	95	1,964
Total	39,493	816,392	38,798	802,026
Estimated exchange equalization on gold produced	....	313,108	....	536,505
Total for Canada	2,949,309	60,967,626	2,972,074	61,438,220
Total estimated exchange equalization on gold produced	....	23,382,611	....	41,098,333
Grand Total value including exchange	....	84,350,237	....	102,536,553

In 1933 the estimated average price of a troy ounce of fine gold in Canadian funds was $28.60, in 1934 the corresponding price was $34.50.

* From Report of Dominion Bureau of Statistics.

† Includes relatively small amounts of gold contained in slags, and ore shipped.

TABLE VI

Ores Mined and Milled, Crude Bullion Recovered and Crude Bullion and Concentrates Shipped in the Auriferous Quartz Mining Industry, 1933 and 1934*

Ton—2,000 pounds

1933	Nova Scotia, Saskatchewan, and Manitoba	Quebec	Ontario	British Columbia	Canada
Number of producing mines......	12	7	28	40	87
Ore mined....................tons	117,130	360,041	5,632,869	418,814	6,528,854
Ore milled....................tons	106,719	344,747	5,612,199	383,111	6,446,776
Tailings re-treated............tons	....	....	....	3,658	3,658
Concentrates produced.......tons	7	11,428	1	18,812	30,248
Bullion recovered by amalgamation............crude ounces	12,203	80,238	186,365	36,689	315,495
Bullion recovered by cyanidation......crude ounces	37,942	5,564	2,523,309	128,124	2,694,939
Bullion shipped......crude ounces	50,538	86,468	2,711,059	164,813	3,012,878
Content of bullion shipped—					
Gold..............fine ounces	37,305	76,919	2,116,142	122,293	2,352,659
Silver.............fine ounces	6,070	5,918	404,744	26,579	443,311
Value.................... $	770,215	1,591,596	43,897,662	2,544,653	48,806,211
Exchange premium........... $	293,653	655,973	15,503,709	1,001,456	17,454,791
Net value of ores, slags and residues sold............. $	1,075	554,480	165,088	2,169,890	2,890,533
Total value of all shipments........ $	1,067,028	2,802,049	59,566,459	5,715,999	69,151,535
1934					
Number of producing mines......	15	10	42	81	148
Ore mined....................tons	152,945	653,035	6,451,743	589,131	7,846,854
Ore milled....................tons	135,111	621,984	6,290,836	427,347	7,475,278
Tailings re-treated............tons	....	....	9,092	18,143	27,235
Concentrates produced.......tons	474	24,895	304	22,875	48,548
Bullion recovered by amalgamation............crude ounces	21,519	95,778	191,317	51,171	359,785
Bullion recovered by cyanidation......crude ounces	34,086	19,645	2,609,813	143,089	2,806,633
Bullion shipped......crude ounces	65,815	775,425	2,784,296	211,592	3,177,126
Content of bullion shipped—					
Gold..............fine ounces	42,349	98,166	2,039,445	151,862	2,331,822
Silver.............fine ounces	6,489	8,061	418,115	31,081	463,746
Value.................... $	876,064	2,032,084	42,362,320	3,153,879	48,424,347
Exchange premium........... $	580,992	1,283,535	26,497,278	2,084,059	30,445,864
Net value of ores, slags, and residues sold............. $	17,180	1,307,820	140,585	3,425,644	4,891,229
Total value of all shipments........ $	1,474,236	4,623,439	69,000,183	8,663,582	83,761,440

* From Dominion Bureau of Statistics Report.

Gold Content of Bullion, Ores, Concentrates, Etc., Shipped and Ore Milled by Auriferous Quartz Mines in Canada, with Average Price of Gold in Canadian Funds, 1929-1934

Year	Tonnage milled	Gold content, fine oz.	Ounces of fine gold per ton	Average price of gold
1929	4,252,994	1,771,526	0·42	$20 67
1930	4,306,869	1,884,791	0·44	20 67
1931	5,450,576	2,271,278	0·42	21 55
1932	5,924,359	2,502,327	0·42	23 47
1933	6,446,776	2,455,365	0·38	28 60
1934	7,475,278	2,490,513	0·33	34 50

TABLE VII

Shipments from Copper-Gold-Silver Mines of Canada, 1933 and 1934*

—	Quantity	Net value	Total metal content as determined by settlement assay				
			Gold	Silver	Copper	Sulphur	Zinc
	tons	$	fine oz.	fine oz.	pounds	tons	pounds
1933							
Nine mines shipped to Canadian plants—							
Ores	867,789	(*a*) 914,642	223,494	328,918	39,561,914	....	....
†Copper concentrates	495,370	4,859,812	171,954	1,619,387	107,952,457	....	....
Zinc concentrates	80,780	565,460	....	....	....	....	55,938,867
Iron pyrites concentrates	....	....	....	....	....	....	....
Four mines shipped to Foreign plants—							
Ore	....	....	....	....	....	....	....
Copper concentrates	28,541	1,104,146	12,933	65,969	14,654,498	....	....
Zinc concentrates	8,929	70,460	....	....	....	....	9,374,675
Iron pyrites concentrates	58,604	189,050	....	....	....	28,178	....
Total	1,540,013	7,703,570	408,381	2,014,274	162,168,869	28,178	65,313,542
1934							
Eight mines shipped to Canadian plants—							
Ores	868,467	829,308	162,797	282,391	33,173,070	....	....
†Copper concentrates	553,515	5,769,226	194,664	1,918,638	120,185,486	....	....
Zinc concentrates	76,149	451,563	5,417	144,559	1,324,297	....	69,331,636
Iron pryites concentrates	1,199	3,769	....	....	....	593	....
Three mines shipped to Foreign plants—							
Ores	....	....	....	....	....	....	....
Copper concentrates	31,866	1,039,511	11,261	79,358	15,348,073	....	....
Zinc concentrates	5,889	72,493	....	....	....	....	5,374,023
Iron pyrites concentrates	35,957	99,201	2,889	....	84,697	4,908	....
Total	1,573,042	8,265,071	377,028	2,424,946	170,115,623	5,501	74,705,659

---

* From Dominion Bureau of Statistics Report.

† Includes some cyanide precipitate.

a The considerable decrease in the value of 1933 shipments as compared with those from 1932 results largely through the companies reporting costs rather than estimates of market prices for metal contents. This practice is confined to some of the larger base metal mining companies which operate both mines and metallurgical plants.

TABLE VIII*

Principal Statistics of the Gold Mining Industry in Canada, 1925-1934

Year	Number of active operators	Number of operating plants or mines	Capital employed $	Number of employees	Salaries and wages $	Cost of fuel and electricity $	Net value of bullion, ore, concentrates, residues and other minerals shipped from the mines and smelters $
ALLUVIAL GOLD							
1925........	99	1,419	22,095,669	363	347,448	....	1,270,419
1926........	108	1,179	4,702,808	285	339,841	44,482	879,886
1927........	94	96	9,653,723	321	472,596	30,834	794,033
1928........	82	82	10,384,575	342	538,270	57,179	852,735
1929........	68	68	7,237,850	488	586,193	2,969	836,006
1930........	79	79	5,881,620	394	612,369	8,272	877,778
1931........	109	....	5,908,001	337	682,935	41,745	1,226,541
1932........	120	....	7,293,818	373	665,711	38,840	1,211,018
1933........	73	....	10,400,905	454	704,151	35,165	1,249,183
AURIFEROUS QUARTZ							
1925........	52	52	84,964,062	7,052	11,931,948	1,836,050	35,035,361
1926........	60	60	103,945,022	7,663	12,340,623	2,083,811	35,171,561
1927........	72	76	118,381,468	8,022	12,935,719	2,222,085	37,452,995
1928........	98	100	147,693,710	9,066	14,615,990	2,554,657	36,655,330
1929........	80	85	135,166,105	8,660	14,258,733	2,579,481	37,275,986
1930........	54	56	119,758,057	8,401	14,034,620	2,364,103	39,750,540
1931........	68	69	109,933,164	9,636	16,467,165	2,700,326	49,108,966
1932........	100	100	58,167,335	10,442	17,686,584	3,031,494	58,645,772
1933........	214	216	158,599,931	12,823	20,536,012	3,330,137	69,151,535
COPPER-GOLD-SILVER							
1925........	40	41	23,200,580	2,374	3,555,844	413,767	7,758,990
1926........	76	84	27,936,685	3,403	4,546,493	541,914	9,973,049
1927........	118	125	24,232,169	4,083	5,260,095	596,137	9,822,881
1928........	164	174	50,004,340	4,777	6,764,309	731,836	15,281,519
1929........	144	152	52,546,697	5,243	8,498,755	1,035,133	21,859,907
1930........	61	68	45,844,395	5,694	9,156,759	1,272,262	15,629,564
1931........	53	56	37,127,920	3,551	4,958,317	726,504	15,951,103
1932........	28	30	14,793,372	3,076	3,770,627	463,463	11,143,759
1933........	28	29	40,228,626	2,841	3,938,778	404,625	7,703,570a
1934........	21	23	39,892,387	3,169	4,869,801	542,670	8,265,071

---

* From Dominion Bureau of Statistics Reports.

The Canadian Government maintains a plant for the production of fine gold at its mint in Ottawa. There are also several company-owned plants in the Dominion equipped for the same purpose, including: that of the Consolidated Mining and Smelting Co. of Canada, at Trail, British Columbia, in operation since 1904; that of the Ontario Refining Co., Ltd., at Sudbury, Ontario, in operation since 1930; that of Canadian Copper Refineries, Ltd., at Montreal East, Quebec, in operation since the latter part of 1931; and one on the Hollinger mine at Timmins, Ontario.

CANADA'S PLACE AMONG GOLD-PRODUCING COUNTRIES

Canada, according to the latest figures to hand, is now third among the gold-producing countries of the world, her present output being surpassed by those of the Union of South Africa and of Russia. From 1930

TABLE IX*

Annual Gold Production of the World and of the Chief Gold-producing Countries, 1901-1934

Year	World total	Union of South Africa	Canada	United States	Australia	Russia
	fine ounces	fine ounces	fine ounces	fine ounces	fine ounces	fine ounces
1901.....	12,740,746	258,032	1,167,216	3,805,500	3,306,205	1,105,475
1902.....	14,354,680	1,718,921	1,032,161	3,870,000	3,487,411	1,090,116
1903.....	15,768,387	2,971,427	911,559	3,560,000	3,836,049	1,191,678
1904.....	16,780,913	3,770,996	796,374	3,892,480	3,777,853	1,199,857
1905.....	18,396,451	4,908,281	684,951	4,265,742	3,663,738	1,078,384
1906.....	19,471,080	5,793,159	556,415	4,565,333	3,451,081	943,142
1907.....	19,997,260	6,452,180	405,517	4,374,827	3,183,601	1,290,854
1908.....	21,430,438	7,057,100	476,112	4,574,340	3,075,237	1,357,027
1909.....	21,982,713	7,296,832	453,865	4,821,701	2,962,552	1,566,443
1910.....	22,022,180	7,531,386	493,707	4,657,017	2,720,695	1,721,163
1911.....	22,348,813	8,251,240	473,159	4,687,053	2,484,031	1,555,333
1912.....	22,549,335	9,108,792	611,885	4,520,719	2,325,932	1,073,875
1913.....	22,249,596	8,798,713	802,973	4,299,784	2,225,716	1,282,357
1914.....	21,240,416	8,396,068	773,178	4,572,976	2,073,198	1,382,867
1915.....	22,760,788	9,096,411	918,056	4,887,604	1,946,975	1,273,362
1916.....	22,107,669	9,296,964	930,492	4,479,057	1,675,700	1,088,437
1917.....	20,289,546	9,018,389	738,831	4,051,440	1,464,208	870,750
1918.....	18,556,920	8,418,379	699,681	3,320,784	1,281,900	580,500
1919.....	17,695,037	8,331,651	766,764	2,918,628	1,079,781	532,133
1920.....	16,205,029	8,158,455	765,007	2,476,166	971,403	57,225
1921.....	15,974,962	8,128,710	926,329	2,422.006	767,571	43,177
1922.....	15,451,945	7,009,858	1,263,364	2,289,235	767,615	146,700
1923.....	17,790,597	9,149,073	1,233,341	2,426,495	724,848	250,673
1924.....	19,031,001	9,575,040	1,525,382	2,446,338	677,625	958,070
1925.....	19,025,942	9,597,592	1,735,735	2,319,920	564,198	985,154
1926.....	19,349,118	9,954,762	1,754,228	2,238,616	526,394	992,155
1927.....	19,397,757	10,122,491	1,852,785	2,117,253	514,504	1,060,950
1928.....	19,755,622	10,354,264	1,890,592	2,144,720	454,065	1,200,000
1929.....	19,500,152	10,412.326	1,928,308	2,056,629	421,476	1,085,384
1930.....	20,836,318	10,716,351	2,102,068	2,100,395	462,164	1,433,665
1931.....	22,329,525	10,877,777	2,693,892	2,213,741	590,423	1,700,960
1932.....	24,141,486	11,558,532	3,044,387	2,219,304	707,412	1,990,085
1933.....	24,150,761	11,013,713	2,949,309	2,276,711	819,927	2,489,375
1934**...	27,346,363	10,479,857	2,972,074	2,916,373	873,127	4,200,000

* Compiled from various sources, including: Dominion Bureau of Statistics (Canada); Repts. of the Director of the U.S. Mint (World, U.S., and largely Russia); Year Books of the Union of South Africa; and Year Books of the Amer. Bur. of Metal Statistics.

** All figures for 1934 except those for Canada and some of those for 1933 are preliminary estimates and therefore subject to revision.

to 1933, both years inclusive, she was the world's second largest producer, her production in 1930 having exceeded that of the United States by a small margin; but since 1932 her output has been almost stationary while that of Russia has been forging ahead rapidly. A preliminary estimate of world gold production in 1934 credits the Transvaal (South Africa) with approximately 39·3 per cent of the world total; Russia with 14·0 per cent; Canada with 11·2 per cent; and the United States, exclusive of the Philippine islands, with 10·3 per cent: comparable figures for 1932 were, Transvaal, 48·0 per cent; Canada 12·7 per cent; the United States 9·5 per cent; and Russia 8·2 per cent. Though Canada's output will probably show considerable increases from now on, there seems little likelihood that her relative position will be changed for some time to come.

Canada's maximum yearly production of gold was 3,044,387 fine ounces, in 1932; that of the Union of South Africa, 11,558,532 fine ounces, also in 1932; and that of the United States 4,887,604 fine ounces, in 1915. World production, as well as that of Russia, was the highest yet recorded in 1934.

As a contributor to the world's total stock of gold won since the discovery of America in 1492, Canada stands in fifth place. It has been estimated that the world's total production of gold from 1493 to 1934, inclusive, was 1,161,158,544 fine ounces (well over half of which has been won since 1900) and that of this total there has been produced by South Africa (Transvaal) 294,612,679 ounces, or 25·4 per cent, since 1883; by the United States, 229,477,261 ounces, or 19·8 per cent, mostly since 1847; by Australia, 151,233,347 ounces, or 13·0 per cent, since 1851; by Russia, 103,230,111 ounces, or 8·9 per cent, since 1741; and by Canada, 49,277,285 ounces, or 4·2 per cent, since 1858.

From 1493 to 1800 Colombia, South America, produced more gold than any other country, or about 27 per cent of the world total for that period. Brazil was second with 24 per cent. During the first half of the nineteenth century, Russia was the largest producer, with 28 per cent; the United States second, with 16 per cent; Colombia third, with 15 per cent; and Brazil fourth, with 11 per cent. During the second half of the nineteenth century the United States and Australia, with 33 and 27 per cent, respectively, of the world's total output to their credit assumed the lead. During the first quarter of the twentieth century the Union of South Africa produced 37 per cent of the world output, replacing the United States as the leading world producer[1]; and in all likelihood South Africa will continue to hold the lead for many years to come.

---

[1] "Summarized Data of Gold Production": Economic Paper 6, U. S. Bureau of Mines, 1929.

CHAPTER III

SOME CANADIAN PRODUCING GOLD MINES

TABLE X

Canadian Lode Mines Producing 20,000 Ounces and Upward of Fine Gold in 1934 (*a*)

Mine	Province	Area	Ounces produced	
			1933	1934
1. Lake Shore	Ont	Kirkland Lake	499,800	472,768
2. Hollinger	"	Porcupine	481,279	434,257
3. Noranda	Que	Rouyn	284,675	248,615
4. McIntyre	Ont	Porcupine	261,528	239,099
5. Wright-Hargreaves	"	Kirkland Lake	177,190	218,203
6. Dome	"	Porcupine	218,485	206,157
7. Teck-Hughes	"	Kirkland Lake	220,036	167,412
8. Flin Flon	Man	The Pas	94,745	99,334
9. Pioneer	B.C	Bridge River	83,827[b]	87,536
10. International Nickel	Ont.[c]	Sudbury	21,355	74,375
11. Siscoe	Que	Harricanaw River	54,771[d]	63,394
12. Beattie	"	Duparquet	22,598	52,905
13. Sylvanite	Ont	Kirkland Lake	44,608	50,337
14. Howey	"	Red Lake	40,460	45,985
15. Bralorne	B.C	Bridge River	18,911	45,296
16. Premier	"	Salmon River	51,863	38,371
17. Macassa	Ont	Kirkland Lake	3,682[e]	32,056
18. Coniaurum	"	Porcupine	33,956	28,436
19. San Antonio	Man	Central Manitoba	22,778[d]	21,638
20. Buffalo-Ankerite	Ont	Porcupine	22,343	20,503
21. Toburn	"	Kirkland Lake	23,020	20,400
22. Kirkland Lake Gold	"	"	18,465	20,316

a Production figures for all Ontario mining companies, except International Nickel, are those given in Bulletin 98 of the Ontario Department of Mines, "Preliminary Report on the Mineral Production of Ontario in 1934"; figures for 1934 production of Pioneer, Siscoe, and San Antonio mines are taken from the "Summary Review of the Gold Mining Industry in Canada 1934" of the Dominion Bureau of Statistics; all other figures are from the companies' annual reports.

[b] For company's fiscal year ending March 31, 1934.

[c] Gold sales reported by the company for the year.

[d] Approximations based on the reported value of bullion produced.

[e] Milling started October 16, 1933.

YUKON

Yukon, the output of which amounted to 38,798 fine ounces in 1934, now stands sixth among Canadian gold-producing provinces; though it was for many years the chief source of gold in the Dominion and its total production from 1885 to 1932 is exceeded only by those of Ontario and British Columbia.

TABLE XI

Total Production of Gold from Yukon, 1885-1934

Year	Fine ounces*	Value	Year	Fine ounces*	Value	Year	Fine ounces*	Value
		$			$			$
1885 1886....	4,837	100,000	1902....	701,437	14,500,000	1918....	102,474	2,118,325
1887.....	3,386	70,000	1903....	592,594	12,250,000	1919....	90,705	1,875,039
1888.....	1,935	40,000	1904....	507,938	10,500,000	1920....	72,778	1,504,455
1889.....	8,466	175,000	1905....	381,001	7,876,000	1921....	65,994	1,364,217
1890.....	8,466	175,000				1922....	54,456	1,125,705
			1906....	270,900	5,600,000	1923....	60,144	1,243,287
1891.....	1,593	40,000	1907....	152,381	3,150,000	1924....	34,825	719,897
1892.....	4,233	87,500	1908....	174,150	3,600,000	1925....	47,817	988,465
1893.....	8,514	176,000	1909....	191,565	3,960,000			
1894.....	6.047	125,000	1910....	221,091	4,570,362	1926....	25,601	529,220
1895.....	12,094	250,000				1927....	30,935	639,483
			1911....	224,197	4,634,574	1928....	34,364	710,367
1896.....	14,513	300,000	1912....	268,447	5,549,296	1929....	35,892	741,954
1897.....	120,937	2,500,000	1913....	282,838	5,846,780	1930....	35,517	734,202
1898.....	483,750	10,000,000	1914....	247,940	5,125,374	1931....	44,310	915,969
1899.....	774,000	16,000,000	1915....	230,173	4,758,098	1932....	40,608	839,442
1900.....	1,077,553	22,275,000	1916....	212,700	4,396,900	1933....	39,493	816,392
1901.....	870,750	18,000,000	1917....	177,667	3,672,703	1934....	38,798	802,026
						Total...	9,093,164	187,972,032

* Calculated from the value: one dollar=0·048375 ounce.

With the exception of a few thousands of ounces contained in auriferous base metal ores all Yukon's output has been of placer gold, the peak of production from which source was reached in 1900.

Gold quartz claims were staked as early as 1899, and with the gradual decrease in production of alluvial gold efforts were made to develop lode mines, in the hope that revenue from this source would replace that from the placers as they became exhausted. So far, however, all attempts to develop gold-quartz mines in Yukon have failed, and such lode gold production as has been reported consists chiefly of small amounts of gold contained in silver-lead and in copper ores exported. These amounts which are included in the table of total production given above, are separately recorded in the one which follows:

TABLE XII

Lode Gold Production of Yukon, 1910-1934*

Year	Fine ounces	Year	Fine ounces	Year	Fine ounces	Year	Fine ounces
1910........	985	1916........	690	1922........	86	1928........	248
1911........	2,640	1917........	1,119	1923........	120	1929........	222
1912........	459	1918........	730	1924........	....	1930........	357
1913........	518	1919........	2,782	1925........	....	1931........	249
1914........	187	1920........	28	1926........	257	1932........	325
1915........	370	1921........	78	1927........	157	1933........	319
						1934**......	95
						Total......	13,021

* Compiled from Dominion Bureau of Statistics Repts. ** Figures subject to revision.

Placer mining operations in Yukon in 1934 were on about the same scale as for several years back. By far the largest producer in the Territory is still the Yukon Consolidated Gold Corporation, which operates a number of dredges on Klondike river and its tributaries. In 1932, this company's reserves of auriferous gravel—proved, probable, and possible—were estimated at 268,000,000 cubic yards containing a total value of $54,500,000 in gold, which would indicate that Yukon's output of alluvial gold would be maintained for many years to come.

A report of a promising discovery of lode gold in Yukon in 1934 revived interest in the lode mining possibilities of the Territory, and indications are not lacking that there will be considerable activity in the search for and development of lode gold properties in 1935. Lode gold production in 1934 was all by-product metal recovered from silver-lead ore.

BRITISH COLUMBIA

In 1934, British Columbia produced 296,196 fine ounces of gold, or nearly 10·0 per cent of the total production of the Dominion, and now occupies third place among its gold-producing provinces.

The earliest recorded discovery of gold in British Columbia was of small gold-bearing quartz veins on Moresby island of the Queen Charlotte group, in 1852; but it was not till the discovery of gold placers on the mainland between 1855 and 1858 that actual gold production started. From 1858 to 1893, all the recorded production is attributed to placers, though mention is made of the erection of arrastres and small stamp mills in an attempt to work lode deposits as early as the eighteen-seventies. Lode mining did not start in earnest, however, until after the completion of the Canadian Pacific railway across the province in 1885. The first recorded production from lode mines was of silver, in 1887, and lode gold does not appear in the records till 1893, nevertheless, a 10-stamp mill was producing gold on the Poorman mine, near Nelson, in 1890. In 1893, the province's lode-gold production was chiefly from gold-quartz mines in the West Kootenay and Yale districts, among the best-known properties being the Poorman, O.K., and Fern in the former, and the Strathyre in the latter district. To these there was added in 1894 the Cariboo-Amelia mine at Camp McKinney in the Yale district, for a number of years the chief gold-quartz mine in the province.

The gold production from the quartz mines was, however, quickly far surpassed by that of the gold-copper mines of Rossland, the first shipments from which were made in 1891, and where a smelter went into operation in 1896. Before the Rossland gold-copper mines were finally closed down in 1928, they had produced about 2,867,000 fine ounces of gold, over 3,600,000 ounces of silver, and nearly 118,000,000 pounds of copper, or about 40 per cent of the recorded gold production of the province to that time. Another formerly important source of gold that came into production a little later than Rossland and continued until 1919 was the low-grade auriferous copper ores of the Boundary district, which were smelted at Phoenix and Greenwood. Other more recent sources of by-product gold have been the low-grade auriferous copper ores of the Britannia, Anyox, and Copper

Mountain mines. In 1903, ten years after it was first recorded, the lode-gold production of British Columbia had risen to 232,831 fine ounces, of which amount the gold-copper ores of Rossland yielded about 145,353 ounces; the low-grade copper ores and the quartz mines of the Boundary district, 50,358 ounces; the Nelson district, the output of which was chiefly from free-milling gold ores, 20,114 ounces; and the southern coast district which included such well-known copper-gold mines as the Marble Bay, Copper Queen, and Cornell on Texada island, 13,371 ounces. The Marble Bay mine was operated practically continuously from 1897 to 1919; and the Britannia mine which was discovered in 1898 also in this district, on the mainland at Howe Sound, is still in operation and is now the largest producer of by-product gold in the province.

Among the first of the gold-quartz mines to be systematically worked on an extensive scale was the Poorman, later called the Granite-Poorman, located on Eagle creek, about six miles westerly from the town of Nelson, on which a 10-stamp mill was built in 1890. This property, during the course of a long and chequered career, in which it passed through many hands and was repeatedly worked by lessees, is estimated to have produced, mostly prior to 1912, over $1,000,000 worth of gold, about 80 per cent of which was recovered by amalgamation and 10 per cent in concentrates. The Fern gold mine also in the Nelson district was profitably worked, producing gold in a 10-stamp mill, in the middle of the eighteen-nineties; while farther west some very rich gold-quartz ore was worked on the O.K. and I.XL. mines, 2½ miles from Rossland. Early in 1894 the Cariboo-Amelia mine at Camp McKinney, about 32 miles west of Midway and 8 miles north of the International Boundary, for a number of years one of the most successful gold-quartz mines in British Columbia, commenced productive operations which were carried on continuously till 1903. Up to the end of 1902, production of bullion and concentrate to the value of $1,105,861.58 had been recorded and $509,337.52 paid in dividends from this mine.

In December, 1898, the first cyanide plant to be built in British Columbia was put into operation at the Dorothy Morton mine on Phillips arm, about 120 miles north of Vancouver on the west coast of the mainland. After about a year's work, however, during which 9,707 tons of ore was treated and 4,434 ounces of gold and 10,222 ounces of silver recovered, the plant was closed down, the ore-bodies it was erected to treat proving to be merely small pockets.

In 1900 an 80-stamp mill was put into operation at the Ymir mine on Wild Horse creek, about 27 miles south of Nelson. The working of this property, which was at one time the largest gold mine in Canada, continued till 1906; the mine output being shipped in the varied forms of bullion recovered by amalgamation and cyanidation, auriferous lead concentrate, and direct-smelting auriferous lead ore. Other considerable producers of gold bullion and concentrate in the vicinity of Nelson at this time were the Yellowstone mine on Sheep creek near Salmo and the Athabasca mine on Toad mountain, 6 miles south of Nelson; and in the Lillooet district the Bras d'Or mine on Cadwallader creek, later known as the Coronation and now part of the Bradian property.

The Nickel Plate mine at Hedley in the Osoyoos mining division, for many years the most important gold-quartz mine in British Columbia, though discovered in 1898, did not become productive till 1904, when a 40-stamp mill for the treatment of a gold-bearing mispickel ore by a combined process of amalgamation, concentration, and cyanidation, was put in operation. The Nickel Plate mine and plant were operated continuously and profitably up till 1920; total operating profits up to June, 1919, being $4,089,000. Work on the mine did not entirely cease, however, until 1930, when the known ore-bodies were exhausted. Later, further work done by new owners—the Kelowna Exploration Company—resulted in the finding of new ore-bodies and the property is again being operated.

Between 1906 and 1917, the only large stamp mill operating in British Columbia was that at the Nickel Plate mine. There was, however, a number of smaller mills operating more or less intermittently—some of them for only very short periods—at numerous points in the province, chiefly in the Nelson and Lillooet mining divisions. Some of those in the Nelson division were, the Granite-Poorman, Queen, Athabasca, Nugget, Mother Lode, Perrier, Fern, Second Relief, Kootenay Belle, Ymir-Wilcox, and Yankee Girl; in the Lillooet division, the Coronation, Pioneer, and Lorne; in the Greenwood division, the Jewel and Carmi; and in Atlin, the Engineer. Stimulated by the higher price of gold many of these old properties after a period of idleness have been reopened, new mills built on them or the old ones reconditioned, and they are again producing. Two of them the Pioneer and the Lorne—now the Bralorne—were British Columbia's largest gold producers in 1934.

The next large gold mine to come into special prominence in British Columbia after the Nickel Plate was the Belmont-Surf Inlet, situated about seven miles inland from the head of Surf inlet on the west coast of Princess Royal island, about 150 miles from Prince Rupert, which occupied the centre of the stage as British Columbia's largest gold producer from 1918 to 1921. This, though essentially a gold mine, was also a considerable producer of copper, all its output being shipped to smelters in the form of auriferous copper concentrate. A 250-ton flotation mill was completed and the first shipments of concentrate made in 1917. In 1918, its output of gold surpassed that of the Nickel Plate, and it continued to be the largest gold mine in the province till, in 1921, its output was in turn surpassed by that of the Premier. In June, 1926, the Belmont-Surf Inlet mine was closed down and the plant dismantled, the known ore-bodies having been worked out after producing some 321,983 ounces of gold, from 836,500 tons of ore treated; and gold, silver and copper to a total value of nearly $8,000,000 of which $1,437,500 was paid out in dividends. Like many other old British Columbia mines it has been reopened and is again being worked under the name Princess Royal Gold Mines, Ltd.

In 1921 the Premier mine near Stewart at the head of Portland canal in the northwestern part of the province became British Columbia's chief gold producer and retained that place till surpassed by the Pioneer in 1933. The Premier, though often thought of as a great silver mine and to some extent as a lead mine, is essentially a gold mine, its total output of gold from July, 1921 to the end of 1934 amounting to nearly 50 per cent of the total production of the province for the same period. British

Columbia's chief gold mines in 1934, in the order of their output were: Pioneer, Bralorne, Premier, Reno, and Cariboo Gold Quartz.

A recent development in the province in the last two or three years has been the bringing into successful production of lode-gold mines near Barkerville, in the Cariboo district. This area, the most productive and one of the oldest placer mining centres in the province was also the scene of some of the earliest attempts to work gold-quartz veins in British Columbia. Gold mills were built in the district as early as the eighteen-seventies; but after a number of unsuccessful attempts at profitable operation lode-mining ceased for many years. Renewed attempts within the last few years resulted in the bringing into production in this district, of the Cariboo Gold Quartz mine in 1933 and of the Island Mountain mine in 1934.

The principal placer mining camps in British Columbia are in the Atlin, Cariboo, and Quesnel districts, while less important areas in the Liard, Omineca, Clinton, Similkameen, Fort Steele, and Revelstoke mining divisions also contribute to the output. Alluvial gold forms only a small part of the province's gold production, but there has been some increase in activity in placer mining during the past two or three years, and it is believed that there are still very considerable quantities of gold to be won by this method in British Columbia.

In 1934, about 7·0 per cent of British Columbia's total gold production was derived from placers and 93·0 per cent from lode mines.

Valuable detailed reports on "Placer Mining in British Columbia" (1931) and on "Lode-Gold Deposits of British Columbia" (1932) have been published by the British Columbia Department of Mines.

TABLE XIII

Placer Gold Production of British Columbia, 1858-1934*

Year	Value	Year	Value	Year	Value	Year	Value
1858....	$ 705,000	1878....	$1,275,204	1898....	$ 643,346	1918....	$ 320,000
1859....	1,615,070	1879....	1,290,058	1899....	1,344,900	1919....	286,500
1860....	2,228,543	1880....	1,013,827	1900....	1,278,724	1920....	221,600
1861....	2,666,118	1881....	1,046,737	1901....	970,100	1921....	233,200
1862....	2,656,903	1882....	954,085	1902....	1,073,140	1922....	364,800
1863....	3,913,563	1883....	794,252	1903....	1,060,420	1923....	420,000
1864....	3,735,850	1884....	736,165	1904....	1,115,300	1924....	420,750
1865....	3,491,205	1885....	713,738	1905....	969,300	1925....	280,092
1866....	2,662,106	1886....	903,651	1906....	948,400	1926....	355,503
1867....	2,480,868	1887....	693,709	1907....	828,000	1927....	156,247
1868....	3,372,972	1888....	616,731	1908....	647,000	1928....	143,208
1869....	1,774,978	1889....	588,923	1909....	477,000	1929....	118,711
1870....	1,336,956	1890....	490,435	1910....	540,000	1930....	152,235
1871....	1,799,440	1891....	429,811	1911....	426,000	1931....	291,992
1872....	1,610,972	1892....	399,526	1912....	555,500	1932....	*b*395,542
1873....	1,305,749	1893....	356,131	1913....	510,000	1933....	*b*562,787
1874....	1,844,618	1894....	405,516	1914....	565,000	1934....	*b*714,431
1875....	2,474,004	1895....	481,683	1915....	770,000		
1876....	1,786,648	1896....	544,026	1916....	580,500	Total..	80,553,701
1877....	1,608,182	1897....	513,520	1917....	496,000		

* From Ann. Repts. of the Minister of Mines, B.C. Gold at standard price up to and including 1931.

b Canadian funds.

TABLE XIV

Lode Gold Production of British Columbia, 1893-1934*

Year	Ounces	Value[a]	Year	Ounces	Value[a]
		$			$
1893	1,170	23,404	1915	250,021	5,167,934
1894	6,252	125,014	1916	221,932	4,587,334
1895	39,264	785,271	1917	114,523	2,367,190
1896	62,259	1,244,180	1918	164,674	3,403,812
1897	106,141	2,122,820	1919	152,426	3,150,645
1898	110,061	2,201,217	1920	120,048	2,481,392
1899	138,315	3,857,573	1921	135,663	2,804,154
1900	167,153	3,453,381	1922	197,856	4,089,684
1901	210,384	4,348,603	1923	179,245	3,704,994
1902	236,491	4,888,269	1924	247,716	5,120,535
1903	232,831	4,812,616	1925	209,719	4,335,269
1904	222,042	4,589,608	1926	201,427	4,163,859
1905	238,660	4,933,102	1927	178,001	3,679,601
1906	224,027	4,630,639	1928	188,087	3,888,097
1907	196,179	4,055,020	1929	145,339	3,004,419
1908	255,582	5,282,880	1930	160,778	3,323,576
1909	238,224	4,924,090	1931	146,039	3,018,894
1910	267,701	5,533,380	1932	181,564	[b]4,261,307
1911	228,617	4,725,513	1933	223,529	[b]6,392,929
1912	257,496	5,322,442	1934	297,130	[b]10,250,985
1913	272,254	5,627,490			
1914	247,170	5,109,004	Total	7,673,990	164,792,126

* From Ann. Repts. of the Minister of Mines, B.C.

[a] Gold at $20.67 an ounce up to and including 1931.

[b] Canadian funds.

BRALORNE MINE

Bralorne Mines, Ltd. was incorporated in 1931, to acquire the property of Lorne Gold Mines, Ltd., consisting of a group of 58 claims adjoining the Pioneer mine in the Bridge River area. Among the claims acquired were the Lorne, Coronation, Blackbird, Ida May, Hiram, and Copeland, all old properties on which work had been done and from which, in some cases, a little gold had been won in the past. In January, 1934, twenty-six claims, forming the southerly and easterly portions of the company's property, including the Coronation and Ida May groups, were transferred to a subsidiary company—Bradian Mines, Ltd.—in which the Bralorne holds a 60 per cent interest. In 1935, Bradian Mines was re-absorbed by Bralorne Mines, Ltd.

A large amount of surface work and tunnelling was done by early operators on the original showings, which were very rich, particularly on the Lorne claim. In 1928 Lorne Gold Mines, Ltd. started the main tunnel on what is now known as the 8th level, at an elevation of 3,416 feet above sea-level. At a point 1,790 feet from the portal a cross-cut was driven 500 feet north to the King vein, to the development of which efforts so far have been largely confined. Raises have been put up from the main tunnel level to surface and an inclined winze has been sunk from it to the 11th level. Measured on the dip of the vein the 9th level is 116 feet below the 8th; the 10th, 150 feet below the 9th; and the 11th, 186 feet below the 10th. The elevations above sea-level of the levels below the 5th are approximately as follows: 6th level, 3,616 feet; 7th, 3,518 feet; 8th, 3,416 feet; 9th, 3,300 feet; 10th, 3,150 feet; and the 11th, 2,964 feet.

The ore-bodies vary from rich narrow quartz veins as little as two feet in width to great bulges as much as 60 feet or more wide, where there has been replacement of the wall rock alongside the original vein. Indicated reserves of ore at the end of 1934 are given as 300,000 tons averaging not less than 0·35 of an ounce of gold a ton.

In February, 1932, a mill capable of treating 100 tons of ore a day by a combined process of amalgamation and concentration by flotation was put in operation. In 1933, milling capacity was increased to 200 tons a day and in 1934 to a rated capacity of 450 tons a day. Actual operating capacity had been gradually stepped up to over 300 tons a day at the end of 1934.

Production by the present operators of Bralorne Mines, Ltd. is as follows:

TABLE XV

Production Record of Bralorne Mine from 1932 to 1934

—	Ore milled	Gold recovered		
		In bullion	In concentrate	Total
	tons	ounces	ounces	ounces
1932*	32,657	16,226·79	6,257·54	22,484·33
1933	54,283	18,911·01	7,024·21	25,935·22
1934	98,664	35,138·12	10,858·12	45,996·24

* Milling commenced on Feb. 6.

CARIBOO GOLD QUARTZ MINE

The property of the Cariboo Gold Quartz Mining Company, Ltd. consists of 74 claims and fractions covering 2,800 acres, situated on the highway from Quesnel—the nearest railroad station—to Barkerville, in the Cariboo district. The new town of Wells, about 55 miles east of Quesnel and about 5 miles west of Barkerville by road is within a mile of the company's mine on Cow mountain on the east side of Jack of Clubs lake.

The first work appears to have been done on the *Pinkerton* and *Rainbow* claims, now part of the Cariboo Gold Quartz property in 1876 or 1877, at which time the diminishing yield of placer gold in the neighbouring creeks caused attention to be turned to the numerous quartz veins that occur in their vicinity. Sporadic attempts over a period of nearly 45 years, however, failed to develop a gold-quartz mine, among the reasons for failure being difficult and expensive transportation, the lack of modern milling methods, and the failure of operators trained for the most part in placer mining to recognize the character and possibilities of the lode deposits. About 1924 or 1925, in the light of increased scientific knowledge of the geology of the district, of modern mining and milling methods, and of improved transportation facilities, renewed interest was taken in the quartz veins; and, in 1927, the Cariboo Gold Quartz Mining Company was incorporated, its main objective being the testing at depth of the Rainbow group of claims.

In 1928, a cross-cut tunnel was started from the left bank of Lowhee creek at an elevation of 4,250 feet above sea-level to explore the Rainbow and Sanders showings, in which good assay values in gold had been found on the surface at an elevation of 4,650 feet. This tunnel was not continued through to its first objective, but it exposed a promising vein of an average width of 9 feet for a length of 150 feet; and a cross-cut from it disclosed the continuation of the Pinkerton vein which outcrops on the company's original claim.

In 1930 a start was made on the driving of a new cross-cut tunnel, No. 15, on the east side of, and 100 feet vertically above, the water-level of Jack of Clubs lake and 375 feet vertically below the upper tunnel. In November, 1933, the first of the Sanders veins was cut, previous to which nine other veins carrying gold had been passed through. At the end of the company's fiscal year ending January 31, 1935, the face of the main cross-cut was 3,801 feet from the tunnel portal and that of L-263 cross-cut 4,552 feet from the same point; and development work in both the Rainbow and Sanders ore zones had proved gratifyingly successful.

Meanwhile, the construction of a 50-ton cyanide mill was started in July, 1932. This went into operation on January 10, 1933, and to the end of the fiscal year, January 31, 1934, had produced 8,395 ounces of gold bullion valued at $260,842 from 21,668 tons of ore milled. In November, 1934, the treatment capacity of the mill was stepped up to 100 tons of ore a day; and production for the fiscal year ending January 31, 1935, was 11,015 fine ounces of gold and 1,163·2 fine ounces of silver, having a total value of $381,852 from 28,772 tons of ore milled. Early in 1935 it was announced that milling capacity would be further increased to 200 tons a day, and that it was expected that the first step in such increase—to 150 tons a day—would be effected by August.

Estimated ore reserves on January 31, 1935, were 99,676 tons averaging 0·416 ounce of gold a ton. Of these reserves 43,068 tons are in the Rainbow ore zone and 35,158 tons in the Sanders zone.

DENTONIA MINE (FORMERLY JEWEL-DENORO)

Dentonia Mines, Ltd. control some 24 claims and fractions including the Jewel, Enterprise, Anchor, Ethiopia, Denoro Grande, etc., at Jewel lake about eight miles by road from Greenwood and seven miles from Eholt, both stations on the Canadian Pacific railway.

The claims constituting the original Jewel property were staked about 1896; and extensive development work was carried out on them by the Jewel Development Syndicate in 1898. The Syndicate later became Jewel Gold Mines, Ltd., which shipped some 2,000 tons of ore to the Granby smelter where it was used for converter lining. Later still the property passed into the hands of Jewel-Denoro Mines Co., Ltd., of Edinburgh, Scotland. In 1905 and succeeding years considerable experimental work was done to determine a suitable method of ore treatment; resulting, after considerable delay, in a 15-stamp mill, in which the gold was recovered in part in the concentrate and in part by sand-leaching cyanidation, being completed and put in operation in 1912, in which year some $15,000 worth of gold was recovered. This first method of treatment was found unsatisfactory, however, and all-slime cyanidation was substituted, the remodelled mill capable of treating 50 tons of ore a day commencing operation in June, 1913. Between that time and the end of the year 8,095 tons of ore were treated, yielding 3,317 ounces of gold and 16,459 ounces of silver having a total gross value of $78,281. In 1914, 16,526 tons of ore were treated, yielding 6,512 ounces of gold and 33,236 ounces of silver; and in 1915, up till August when operations were suspended, 6,724 tons which yielded 2,250 ounces of gold and 9,725 of silver. In 1916, lessees who were working the mine treated 2,654 tons of ore in the mill. In 1926 and 1927 lessees were again working on the property and made some small shipments of cleanings from the mill, of sorted ores from the waste dump, and of high-grade ore found near the surface in an old shaft.

In 1930, the Jewel-Enterprise group was optioned by a Calgary syndicate and in the following year Dentonia Mines Ltd. was incorporated to take over these and adjoining claims. Practically no development was done by the new owners till August, 1933; by which time a number of neighbouring claims including the Gold Drop, North Star, etc., had also been brought under the control of the company. In April, 1934, a 100-ton flotation plant had been installed in the old mill-building, treating ore from the second level of the old workings and from the old dumps. Since May, regular shipments of concentrate have been made to Trail and the owners report that 23,000 tons of ore were milled during the eight months the mill was in operation in 1934. Development work is now being carried on from a cross-cut tunnel 1,330 feet in length and 340 feet below the present working level. This cross-cut tunnel will be made the main haulage level when connexion has been made with the upper workings.

ISLAND MOUNTAIN MINE

The group of claims constituting the property of Island Mountain Mines Co., is situated on the Quesnel-Barkerville highway, about five miles west of Barkerville, on the north side of Jack of Clubs lake directly opposite the Cariboo Gold Quartz mine.

The first work on these claims appears to have been done in the late eighteen-seventies. In 1887, the Island Mountain Mining Company is reported as moving their 10-stamp mill from its location on Williams creek to the outlet of Jack of Clubs lake and as taking out ore at their mine. In 1890, the mill is reported as having been completed and put in operation on August 20. It appears to have been in operation but a very short time and a few hundred tons of ore only to have been treated; the obstacles to successful milling apparently proving insurmountable by the methods then available. For many years the property lay idle and the mill, originally built with Provincial Government assistance, passed into Government possession.

For some years previous to 1932 the property was owned by C. J. Seymour Baker of Barkerville, who cleaned out the old workings and opened them to inspection with the result that the property was acquired in 1933 by the Newmont Mining Co., of New York, and a subsidiary, Island Mountain Mines Co. Ltd., was formed to work it. A 50-ton cyanide mill was built and went into operation in November, 1934. Early in 1935 it was reported that milling capacity would probably be doubled before the end of the year. The outlook for the property was considerably improved by the discovery in 1934 of ore-bodies of a new type, viz., sulphide replacements in limestone beds as contrasted with the narrow quartz veins on which all previous work had been done.

KOOTENAY BELLE MINE

The property of Kootenay Belle Gold Mines, Ltd. consists of 200 acres of Crown-granted mineral claims on Sheep creek. It is about seven miles southeasterly from the town of Salmo with which it is connected by automobile road.

The Kootenay Belle is an old mine on which considerable work was done twenty-five or thirty years ago. In 1908 and 1909 a 4-stamp mill was reported in operation and shipments of ore are recorded at various times, production up to 1911 being given as 5,137 tons valued at $104,966. From 1911 to 1927 the only production recorded was 28 tons of high-grade ore shipped in 1923. In 1927 the mine was again worked in a small way, some four carloads of ore being shipped; in 1928, seven carloads. Before the end of 1928, however, work was again suspended. Total production to 1928 was 5,687 tons of ore yielding 6,693 ounces of gold and 2,885 ounces of silver. During the last four months of 1932, 236 tons of ore was shipped from the property and in February, 1933, Kootenay Belle Gold Mines, Ltd. was incorporated to take over its operation. From February to December, 1933, 673·5 tons of ore was shipped to Trail, yielding 920·48 ounces of gold and 465·28 ounces of silver of an average net value of $32 a ton including gold premium. In November, 1934, a 50-ton mill including a Hadsel crushing unit was put in operation to treat the ore by blanket concentration, amalgamation, and flotation.

Two main veins have been developed on the property, through three adits, viz., "C", No. 1, and No. 2, to a depth of about 350 feet below the highest outcrops. The lowest adit, No. 2, is connected with the mill on the Sheep Creek road by an aerial tramway 1,500 feet in length up the steep face of Yellowstone mountain. Power is obtained from the West Kootenay Power and Light Company's transformer station for the Sheep Creek camp close by the mill.

MINTO MINE

The property of Minto Gold Mines, Ltd. consists of the Alpha Group of mineral claims situated about a mile below the junction of Gun creek with Bridge river, on the highway connecting Bridge River station with the Pioneer mine.

Prior to its acquisition by the present owners in 1933, the property had been developed by three tunnels 400, 300, and 200 feet in length, respectively. According to the company's first annual report, dated June

30, 1934, the Warren, or upper tunnel, had been driven 409 feet on the strike of the vein; the Hagmo tunnel 110 feet below the Warren, had been driven 1,200 feet; and the Working tunnel, 185 feet below the Hagmo, 957 feet. The company's consulting engineer estimated that some 98,500 tons of ore at least had been indicated by these workings, consequently a 50-ton mill to treat the ore by amalgamation and flotation was built and went into operation in December, 1934. The average width of the vein is said to be between four and five feet and the average value $13.29 a ton with gold at $30 an ounce.

PIONEER MINE

The property of Pioneer Gold Mines, Ltd. covers approximately 700 acres, situated about 50 miles by road from Bridge River Station on the Pacific Great Eastern railway, in the Bridge River area of the Lillooet mining division.

The original Pioneer claim was staked in 1897. For eleven summers it was operated single-handed by the owner, Mr. F. H. Kinder, who managed alone to mine and mill sufficient ore to make a comfortable living, the crushing being done in a small home-made arrastre driven by a water-wheel set up on Cadwallader creek and capable of crushing 400 or 500 pounds of ore a day.

In 1911, Kinder sold the property to the Pioneer Syndicate, who after further developing it, set up in 1916, a 5-foot Bryan mill with amalgamation plates, and a Diester table, all driven by a Pelton water-wheel. Production was continuous from 1916 to 1919, but the mine was idle in 1920. In 1921 it was reopened by new owners and a cyanide plant added to the equipment. In 1922 a vertical shaft had been sunk to a depth of about 230 feet on the vein, but when the developed ore-shoots were stoped out, operations again ceased.

In 1924, arrangements were made by the owners whereby further development was carried on by returns derived from ore mined in the old stopes. By the end of 1926, development had been carried to a depth of 500 feet, with extremely favourable results. In 1928 the property was acquired by Pioneer Gold Mines of British Columbia, Ltd.; a new vertical shaft was put down; and sufficient ore reserves were developed to warrant the building of an 80-ton cyanide mill. Rated mill capacity was increased from time to time and reached 400 tons a day in 1934.

In 1933, a new vertical shaft, No. 3, was completed to a depth of 1,625 feet, or to the 14th level, and is now the main hoisting shaft. According to the company's annual report for the fiscal year ending March 31, 1935, the No. 2 shaft was deepened to a point below the 22nd level (2,625 feet deep) and was equipped with a new head-frame, electric hoist, etc.; and it is planned to continue the sinking possibly to the 26th level, i.e. to a depth of 3,125 feet below the collar. At the end of the fiscal year ore actually blocked out—all above the 14th level—amounted to 307,400 tons carrying on the average 0·7 ounce of gold a ton.

During the fiscal year ending March 31, 1931, 26,700 tons of ore having a gross value of $14.52 a ton were treated, yielding bullion to the value of $350,000; for the same period ending March 31, 1932, 37,234 tons of ore of a gross value of $19.43, yielded bullion worth $680,798.03; during the year ending March 31, 1933, 62,413 tons of ore of a gross value of $18.55 yielded gold to the value of $1,104,190.60 and silver to the value of $2,664.32; during the year ending March 31, 1934, 77,584 tons of mine ore carrying 0·7837 of an ounce of gold a ton and 3,658 tons of old tailing carrying 0·2677 of an ounce of gold a ton—or an average of 0·7670 of an ounce a ton—yielded 83,826·85 ounces of gold valued at $1,735,079.49 and 15,712·17 ounces of silver valued at $6,152.06. During the year ending March 31, 1935, 130,545 tons of ore milled yielded 86,763·13 ounces of gold valued at $3,079,790.12, including premium, and 15,661 ounces of silver valued at $7,862.73.*

PREMIER MINE

The Premier Gold Mining Company's Premier mine includes a large group of mining claims situated about ten miles due north of the north end of Portland canal, close to the boundary line separating Alaska from British Columbia. It can be reached from the town of Stewart, British Columbia, by an excellent motor road about 17 miles in length, which for the greater part of this distance is built through Alaskan territory.

Metalliferous deposits in the vicinity of Portland canal first received attention in 1898, at the time of the Klondike rush, but little development work was done before 1907. The original Premier claims were staked and recorded in the summer of 1910, and these together with some other adjoining claims were acquired by the Salmon Bear River Mining Company, Ltd. This company began development work in the spring of 1911, continuing it during the summers of that and the following year. The property lay idle in 1913. During the next three years it was extensively explored by prospective purchasers with, on the whole, unsatisfactory results, though a little high-grade ore was found in 1914. In March, 1917, it was bonded to Messrs. Trites, Woods and Wilson, and shortly after work was started on their behalf a large body of high-grade gold-silver ore was found. In 1919, the American Smelting and Refining Company bought a controlling interest in the mine and proceeded to equip it for production. A 100-ton concentrating mill was built; also an aerial tramway 12 miles long to convey ore and concentrate from the mine and mill to a shipping pier on tidewater at the head of Portland canal. Milling capacity was gradually increased until it is now over 400 tons a day. For a time a cyanide plant was operated in connexion with the mill but has not been in use since 1925. In 1927, the use of tables also was discontinued and the milling process changed from combined gravity and flotation, to all flotation. Concentrate is now the only product shipped, the shipping of direct-smelting ore having ceased in 1933.

The ore-bodies, which have a vertical extent of about 1,400 feet, are opened up on six levels by adits; and there are more than 15 miles of underground workings including drifts, cross-cuts, and raises. The very high grade ore, found chiefly in the upper levels, has been largely depleted and output is now dependent on the milling of lower grade ore. To quote the company's annual report for the year ending December 31, 1934,

---

* Gold values throughout this paragraph figured at the standard price of $20.67, except where otherwise stated.

" In previous annual reports it has been made clear that the Premier oreshoot bottomed as to commercial values slightly above the 5th level with a few roots of ore of profitable grade persisting down . . . . . . to the 6th level. But with gold at approximately $35 per ounce, less Government tax, and silver around 50 cents Canadian currency, there was brought into the category of profitable ore a considerable tonnage of broken material heretofore unprofitable, and likewise a considerable tonnage of unbroken material. This higher price coupled with an intensified program of underground exploration and development above the 6th level . . . . . has resulted in establishing at the end of 1934 a combined broken and unbroken ore reserve . . . . of 180,800 tons " averaging 0·24 ounce of gold and 5·0 ounces of silver a ton, as against reserves on December 31, 1933, of 87,134 tons averaging 0·36 ounce of gold and 6·87 ounces of silver a ton.

From the commencement of regular production by the Premier company to December 31, 1934, a period of 15 years and one month, there was mined and milled or shipped crude from the Premier mine a total of 2,673,417 tons of ore which yielded 1,370,440 ounces of gold and 34,530,264 ounces of silver. Profits, before deducting depreciation and depletion charges, were for the same period $22,005,166, of which $17,858,075 was paid out in dividends to shareholders.

TABLE XVI

Production and Dividend Record of Premier Gold Mine, 1919-1934*

Year	Ore mined, tons	Ore shipped, tons	Concentrate shipped, tons	Cyanide precipitate shipped, tons	Gold and silver produced		Dividends authorized $
					Gold, ounces	Silver, ounces	
1919	488	....	....	....	3,209	108,285	....
1920	799	....	....	....	2,283	77,180	....
1921	18,750	4,356	1,000	5	40,104	1,177,978	400,000 00
1922	102,334	69,990	4,125	13	127,827	4,474,367	2,773,125 00
1923	145,665	87,869	7,175	11·36	117,294	2,746,551	1,738,000 00
1924	159,014	97,049	8,524	13·55	139,288	3,015,382	1,715,000 00
1925	168,557	112,853	6,357	7·95	119,725	2,559,192	1,600,375 00
1926	230,987	108,835	19,997	Nil	126,324	3,187,618	1,600,987 50
1927	244,172	96,637	26,051	....	118,842	3,396,082	1,601,062 50
1928	275,811	113,699	17,081	....	131,744	2,607,645	1,300,898 43
1929	266,972	101,829	14,631	....	98,442	2,429,751	1,210,218 75
1930	256,836	104,900	15,616	....	90,084	2,760,787	1,050,773 43
1931	242,317	72,558	20,271	....	82,394	1,718,376	635,713 14
1932	221,718	69,120	16,135	....	78,716	1,713,037	679,899 71
1933	185,421	9,647	Nil	....	51,863	1,145,043	628,571 43
1934**	154,693	Nil	Nil	....	38,371	657,039	600,000 00

* Figures from 1922 to 1934 compiled from Annual Reports of the Premier Gold Mining Company, Ltd.

** Milling and mine production interrupted by the destruction by fire of the company's power plant on November 2, 1934.

QUEEN MINE (SHEEP CREEK GOLD MINES, LTD.)

The property of Sheep Creek Gold Mines, Ltd. includes the Queen, Yellowstone, Hide Away, and Alexandra groups of claims situated along the valley of Waldie (Wolf) creek immediately above its junction with Sheep creek. It is about 10 miles by motor road from the town of Salmo.

Development of the Sheep Creek camp was started on the Yellowstone claims, in 1899, by Yellowstone Mines, Ltd. In February, 1900, a 10-stamp mill was completed and put into operation. Production was reported in 1900 and in 1901, during which time 16,987 tons of ore was treated yielding 5,912 ounces of gold and 4,354 ounces of silver; but in the following year the mine was abandoned, the ore-shoot from which production had been obtained having been worked out. The mill was then leased to the operators of the adjoining Queen claims and later the two properties were merged. No production from the Yellowstone mine has been recorded since 1902.

The first production from the Queen mine was in 1902 when the Holmes Syndicate treated some 4,000 tons of Queen ore in the Yellowstone mill and shipped 246 tons direct to smelters. In 1903 a tramway was built from the Queen mine to the Yellowstone mill, which in 1907 was acquired outright by the owners of the Queen, and enlarged to twenty stamps. Steady production was maintained from 1902 to 1916, a total of 116,076 tons of ore, yielding returns in gold and silver of $1,188,326, being treated during this time. According to report this represented a recovery of only about 65 per cent of the value of the ore.

In 1916, a cave-in at the shaft caused a suspension of operations till 1918, when a lease and bond were taken on the property by new operators, and a long cross-cut tunnel was started to tap the deposit at a depth of 700 feet from the outcrop. The Queen vein was cut at this depth 1,600 feet in from the tunnel mouth, but proved disappointing and work was stopped in 1919. In 1926 the mine was again under lease and bond and some of the old dumps were put through the mill. In 1928, some ore from the Alexandra vein was milled by lessees; and in 1930 the property was acquired by Queen Mines, Ltd. At this time the Queen vein from which the great bulk of the ore mined had come had been opened by three adits on the west side of Waldie creek and one on the east side; and the Yellowstone and Alexandra veins by three adits on each.

Queen Mines, Ltd. did development work in 1930 and 1931; and in 1932 the mill was operated intermittently on ore from the Alexandra vein and from the upper levels of the Queen, above the flooded workings. In 1933, the property of Queen Mines, Ltd. was consolidated with the adjoining Vancouver, Midnight, and other claims of the Midnight Mining Syndicate under the name Sheep Creek Gold Mines, Ltd. Some new equipment was installed in the mill and a test run made on 150 tons of ore which yielded $1,637.73 in gold. Eleven hundred tons also was treated by flotation, yielding 125 tons of concentrate. As a result of these tests and of favourable developments underground it was announced in August, 1934, that a new mill of 100 tons daily capacity would be built to treat the ore by cyanidation. Mill construction was well under way by the end of the year. Power will be obtained from the West Kootenay Power and Light Company's transformer station at the Yankee Belle mill a short distance away.

RENO MINE

The Reno mine, the property of Reno Gold Mines, Ltd., consists of sixteen mining claims situated at the head of Fawn creek, a tributary of Sheep creek, about 15 miles by road from the small town of Salmo on the

Nelson and Fort Sheppard branch of the Great Northern railway. It is about 30 miles south of the city of Nelson.

Most of the claims now included in the Reno property were staked about 1912 or 1913. The present operating company, Reno Gold Mines, Ltd., was incorporated in 1920. Though considerable exploratory work had previously been done, active development of the property did not commence till 1928.

The early exploratory work done on the vein was through four short adits. Since the beginning of the present operations in September, 1928, underground work has been largely confined to the two lower of these, viz: adit levels Nos. 3 and 4, and to the driving of a new adit, No. 5, about 283 feet vertically below No. 4. No. 5 adit had been driven about 1,000 feet by the end of 1931, and had reached the vein, which now has been drifted on to open up the downward continuation of the ore-shoots on the No. 4 level.

The vein being worked is narrow but rich both in its outer oxidized portion and at the inner ends of the adits, where unaltered sulphides are encountered. In this respect it has proved an exception to the general experience in the district where it has usually been found that, when workings passed from oxidized to unaltered portions of a vein, there was a sharp decrease in the gold content, which made the working of the primary sulphide ores unprofitable. The richness in gold of the sulphides so far found on the Reno vein adds greatly to the possibilities of developing extensive ore-bodies.

In August, 1929, a 30-ton cyanide mill was completed and put in operation, which up to the end of December, 1930, produced bullion to the value of $199,798 from about 11,670 tons of ore.

During the year 1931, 11,944 tons of ore of an average value of $18.87 a ton was treated, yielding a total of $201,570 exclusive of premium; the average mill recovery being about 92·4 per cent of the gold in the ore. Of this amount 40 per cent was recovered by amalgamation; 53 per cent by cyanidation; and 7 per cent in concentrate.

On February 25, 1932, the mill was destroyed by fire, following which the neighbouring Motherlode and Nugget mines were acquired and the old mill on the Motherlode reconditioned to treat Reno ore. The rehabilitated Motherlode mill, having a rated capacity of about 100 tons of ore a day, or double that of the old Reno mill, was put in operation early in 1933. The company also built a hydro-electric plant on Sheep creek to supply mine and mill with power, and an aerial tramway to connect the mine with the new mill. During the year ending April 30, 1932, 10,634 tons of ore was milled, which yielded gold to the value of $190,715.27 or at the rate of $17.93 a ton. During the time that the reconditioned Motherlode mill was in operation, in the company's fiscal year ending June 30, 1933, 11,059 tons of ore was milled, yielding gold bullion to the value of $118,621.09, and auriferous concentrate to the value of $3,538.30, or a total of $122,159.39 with gold at the standard price. Premium received on gold produced amounted to $34,802.42.

During the 12 months ending June 30, 1934, preparations were made for deepening the shaft; additions were made to the milling equipment; some changes made in milling practice; and a contract was entered into with the West Kootenay Power Company for a reserve supply of power.

Despite a serious interference with operations caused by a break in the water power pipe-line, 23,717 tons of ore was milled in 1934 which yielded:

—	Gold, ounces	Silver, ounces	Lead, pounds
Bullion bars, containing	10,930 50	4,620 36	....
Concentrate, containing	1,348 58	1,697 10	20,565
Refinery by-products, containing	101,35	186 14	....

the whole having a total value of $259,019.63 with gold at $20.67 an ounce. Premium received on gold was $160,351.91; and net profit was $52,731.70.

SECOND RELIEF MINE

The Second Relief mine of Relief Arlington Gold Mines, Ltd., now controlled through a 52 per cent stock interest by Premier Gold Mining Co., Ltd., is situated on Erie creek about 13 miles by road from the Great Northern railway at Erie, which is about three miles west of the town of Salmo, the central point of the district.

This is an old property that was operated intermittently for many years—largely by lessees. In 1901, a 10-stamp mill and Wilfley table was in operation on the property; later, a small cyanide plant was built also, but not proving a success was discarded in 1904. Some production, partly bullion recovered by amalgamation, partly concentrate carrying gold, silver, and copper, was reported every year from 1901 to 1915; though operations were often hampered by lack of water to drive the Pelton wheels that supplied the mine with power. Extraction up to this time is said to have been only 50 or 60 per cent of the gold contained in the ore.

In 1916 the milling plant was remodelled with a view to improving the extraction; a tube mill was added to recrush the tailing from the Wilfley table, and a cyanide plant to treat the tube mill product. Production was reported in 1918, 1919, and 1920; that of 1920 being concentrate salvaged from the mill which was destroyed by a forest fire in 1919. It is estimated that the total production of the mine, from 1900 till the mill burned down in 1919, was at least 50,000 tons of an average value of $15 a ton, a large part of which was left in the mill tailing.

From 1919 to 1927 the mine was idle, but in the latter year a new mill was built to recover the gold by amalgamation and concentration; a new flume 8,600 feet long to supply water for the power plant; and a short tramway to connect the mine with the mill. In 1929 the Second Relief Mining Co., Ltd. was amalgamated with the Arlington Mining Company, owners of adjoining property, under the name Relief-Arlington Mines, Ltd.; and some further changes were made in the Second Relief mill. Activities were intermittent between 1927 and 1933. In June, 1933, however, operations were started under new management. Mining and milling plants were thoroughly overhauled and numerous improvements made. Also, underground development was speeded up—with good results—so that during the five months ending December 15, 4,856 tons of ore was mined and 3,538 tons was milled, yielding 1,606·65 ounces of gold and 338·7 ounces of silver of a gross value of $51,120. In the spring of 1934 the Premier Gold Mining Company acquired the property and have been working it steadily since. The mill as at present constituted treats about 30 tons of ore a day by amalgamation and concentration by flotation. In the middle of 1934 preparations were being made to sink a 2-compartment shaft 300 feet below the 5th level as a first stage in the testing of the deposits at depth, and it is planned to increase milling capacity to 65 tons a day.

VIDETTE MINE

The Vidette mine, property of Vidette Gold Mines, Ltd., is situated on the shore of Vidette lake near the headwaters of Deadman creek, about 43 miles north of Savona on the Canadian Pacific railway. It consists of some twenty-two claims and fractions covering about 1,300 acres; development has been chiefly on *Searcher No. 1* and *Searcher Fraction.* A new road about 17 miles in length from Tobacco Flats to the mine was completed in the autumn of 1934.

In 1932 a small plant was set up on this property to test the ore from a series of narrow quartz veins and at the same time provide funds to aid in their development. Later a 50-ton flotation mill was installed, in which ore treatment by flotation at the rate of between 30 and 40 tons a day commenced in April, 1934. According to the company's annual report for the fiscal year ending September 30, 1934, production amounted to 3,070·39 ounces of gold, 5,238 ounces of silver, and 6,444 pounds of copper.

A main three-compartment inclined shaft started in September, 1933, was completed to a depth of 500 feet in February, 1934. From this, work was carried on at three levels and 600 feet of ore was cut on the first level. No official estimate of proved ore reserves has been published, owing to uncertainty concerning the vein below the second level, beyond the statement that at least eight months' supply at the present rate of milling was available on September 30, 1934.

During 1934 the Vidette interests secured control also of the Monashee mine, on Monashee mountain near Vernon, in which already some 45,000 tons of ore is said to be indicated.

WAYSIDE MINE

The Wayside mine consisting of 27 claims is situated on the main highway between Bridge River station and the Pioneer mine, about eight miles north of the latter.

The original claims forming the nucleus of the property were staked in 1900. These after passing through several hands and the addition of other claims to the group became, in 1928, the property of Wayside Consolidated Gold Mines, Ltd. By the end of 1932—though little work had been done for several years previously—eight exploratory tunnels had been driven and numerous open-cuts made on several quartz veins lying in a zone of parallel fractures in the country rock. A one-stamp mill also had been set up on the Wayside claim on which the principal workings are grouped.

Active development was resumed in March, 1933, and in June a large shear zone containing wide auriferous quartz veins was found on the No. 3 level. On these most of the subsequent work has been done. Towards the end of 1933 it was proposed to erect a 100- or 150-ton mill, but after several adverse reports by examining engineers this plan was dropped. Instead, a small pilot mill was erected to treat the ore by amalgamation and this has been in steady operation treating about 20 tons of ore a day since November, 1934.

WINDPASS MINE

The Windpass Gold Mining Company, Ltd. property consists of some 36 claims situated about 8 miles from Chua Chua station, which is 55 miles north of Kamloops on the Canadian National railway.

The original Windpass claims—Windpass No. 1, No. 2, and No. 3—were staked in 1916, when 3½ tons of ore carrying 2·48 ounces of gold and 0·9 ounce of silver a ton was shipped to Trail. In 1917, 29½ tons assaying 2¼ ounces of gold and 1·5 ounces of silver a ton was shipped. Later the property was bonded and finally acquired by Messrs. Trites, Wood and Wilson, who developed it extensively to a depth of 300 feet and had blocked out a considerable tonnage of ore by 1925. The assay values, however, were found to be erratic and the property lay idle from 1925 to 1933. In 1933, the mine was unwatered and preparations made for stoping above No. 1 level; also two cars of high-grade gold ore were shipped. A power transmission line, an aerial tramway, and a telephone line were built from the mine to Dunn lake, 2½ miles away, where a site was cleared for a main camp and mill. A 50-ton mill in which the ore is treated by table and flotation concentration was completed and put in operation in March, 1934. The concentrate is shipped to smelters.

YMIR YANKEE GIRL MINE

The Yankee Girl mine, situated on the north slope of the valley of Bear creek, consists of five claims comprising 177 acres, 17 miles south of Nelson and about 1½ miles east of the town of Ymir. The mill, connected with the mine by aerial tram, is about 300 feet from the Great Northern railway at Ymir.

The claims now included in the property were staked at various times between 1896 and 1901; and some 200 tons of ore valued at $6,600 is recorded as having been taken out by early owners or by lessees. In 1907 a United States syndicate bonded the property and built an aerial tramway from the mine to a point on a wagon road about a mile and a half from the Great Northern railway at Ymir. They were unable to complete the purchase however and threw up their bond before the end of the year. In 1908, the property was again under bond; and in 1909 passed into the possession of Yankee Girl Gold Mines, Ltd., who shipped 2,622 tons of ore valued at $64,000 to the Trail smelter before the end of the year. In 1910, 4,738 tons of ore was shipped; and in 1911, 1,352 tons. Towards the end of 1911 the mine was sold to the Hobson Silver Lead Co., Ltd., who carried on development work and made shipments of ore more or less continuously till 1914. No shipments were made in 1915; but they were resumed in 1916 and continued till December, 1918, when the mine was closed down, operation being no longer profitable. Total shipments up to this time are reported as 23,685 tons having a gross value in gold and silver of $470,000; the average content being 0·70 ounce of gold and 3·34 ounces of silver a ton, together with 1·44 per cent lead and 5·50 per cent zinc.

In the spring of 1920 Canada Mining Corporation took an option on the property and shipped out six cars of ore for test purposes; but dropped their option before the end of the year. In 1926, the mine was acquired by Yankee Girl, Ltd., by whom it was reopened and re-equipped. In 1927, Porcupine Goldfields Development and Finance Co. had it under option. In 1928 it passed into the hands of Yankee Girl Consolidated Mines, Ltd., who kept it in operation till the latter part of 1929, when work was suspended. Ore shipments were made steadily from 1926 up to the closing of the mine in 1929.

In March 1932, shipments from the mine were resumed by E. P. Crawford and associates who had taken over the property under agreement with the then owners, Texas Yankee Girl, Ltd.; 8,150 tons of ore being shipped to the Trail smelter before the end of the year. During 1933 the same parties mined and shipped 13,456 tons, from which there was recovered 6,793 ounces of gold, 38,309 ounces of silver and 655,622 pounds of lead. The total production of shipping ore up to Dec. 31, 1933, is said to have been 87,000 tons for which smelters paid more than $1,100,000.

In 1934, Ymir Yankee Girl Gold Mines, Ltd., a British Columbia incorporation, was floated to acquire and work the property. At the end of the year a 100-ton flotation and cyanidation mill, connected with the mine by an aerial tramway 6,000 feet long, had been built and was about ready to go into production alongside the railway at Ymir. Meantime ore shipments were maintained throughout the year at the rate of about 1,000 tons a month averaging 0·77 ounce of gold a ton. According to the prospectus issued by the present company development at the mine consists of 11,000 feet of lateral work and 1,400 feet of raises on the Yankee Girl vein above the 1,235-foot adit—the main working level; this development having a length of 2,500 feet and a maximum depth of 1,500 feet. Some exploratory work has also been done on the Lakeview and Spur veins. Reserves of reasonably assured and probable ore are given as 286,600 tons having an estimated gold content of 0·47 ounce a ton.

ALBERTA

In Alberta small quantities of alluvial gold are recovered annually by washing from sand and gravel bars of the Saskatchewan river. Latterly, however, production from this source has been almost negligible. No lode gold has ever been mined in the province.

It may be noted however that some 5,000 square miles in the northeastern corner of Alberta are underlain by the same Precambrian rocks that have proved favourable to gold deposition in other parts of the Dominion.

TABLE XVII

Production of Gold from Alberta, 1887-1934*

Year	Fine ounces**	Value	Year	Fine ounces**	Value	Year	Fine ounces**	Value
		$			$			$
1887....	102	2,100	1903....	48	1,000	1919....	24	500
1888....	58	1,200	1904....	24	500	1920....	....	....
1889....	967	20,000	1905....	121	2,500			
1890....	193	4,000				1921....	49	1,013
			1906....	39	800	1922....	....	....
1891....	266	5,500	1907....	33	675	1923....	....	....
1892....	508	10,506	1908....	50	1,037	1924....	....	....
1893....	466	9,640	1909....	25	525	1925....	....	....
1894....	726	15,000	1910....	89	1,850			
1895 ...	2,419	50,000				1926....	....	....
			1911....	10	207	1927....	42	868
1896....	2,661	55,000	1912....	73	1,509	1928....	68	1,406
1897....	2,419	50,000	1913....	....	....	1929....	5	103
1898....	1,209	25,000	1914....	48	992	1930....	....	....
1899....	726	15,000	1915....	195	4,026			
1900....	242	5,000				1931....	195	4,031
			1916....	82	1,695	1932....	83	1,716
1901....	726	15,000	1917....	....	....	1933....	324	6,698
1902....	484	10,000	1918....	27	558	1934....	393	8,124
						Total.	16,219	335,275

* From Dominion Bureau of Statistics Repts.

** Calculated from the value: one dollar=0·048375 ounce.

SASKATCHEWAN

The production of gold in Saskatchewan was first recorded in 1932, all the output to date coming from that portion of the Flin Flon copper-zinc-gold mine lying within the boundaries of the province. Nevertheless, some 251,700 square miles, or about one-third of Saskatchewan is underlain by Precambrian rocks, the commercial mineral-bearing possibilities of which have so far received scant attention.

TABLE XVIII

Production of Gold from Saskatchewan, 1932-1934*

Year	Fine ounces	Value**
		$
1932	11	227
1933	5,400	111,628
1934	5,405	111,731
Total	10,816	223,586

* From Dominion Bureau of Statistics Reports.

** Calculated from the value: one dollar=0·048375 ounce.

MANITOBA

Though the history of gold mining in Manitoba is a very short one, nevertheless that province now stands fourth among the gold-producing provinces of the Dominion, its production in 1934 being 132,321 ounces, or about one-half of that of British Columbia, Canada's oldest gold producer. Most of the Manitoba output is obtained in the course of treatment of low-grade auriferous copper-zinc ores from the Flin Flon mine. The remainder is won from gold-quartz mines, at present chiefly from the San Antonio and Central Manitoba mines. Notable developments both in the God's Lake and Central Manitoba areas, as well as in other parts of the province, indicate that a number of new producers will be recorded in 1935.

Local tradition has it that gold was discovered on Black island in lake Winnipeg, just off the mouth of Wanipigow (or Hole) river, in 1881; and on the mainland, on the south side of Wanipigow river near its mouth, in 1895 and 1896. Interest in these early discoveries, whatever they may have amounted to, appears, however, to have died down quickly and it was not until ten or twelve years later that reports of the discoveries being made in northern Ontario caused prospecting again to become active in Manitoba also. In 1908 a few claims were staked up the Wanipigow river, but no work was done on them. Early in 1911 gold was found on the Gabrielle claim on Rice lake, which was the centre of considerable activity for a few years. Other discoveries followed at intervals: at Gold lake, Long lake, Bulldog lake, Hay lake, etc., until we find, to-day, a belt of country following the watersheds of the Wanipigow and Manigotagan (Bad Throat) rivers from lake Winnipeg to the Ontario boundary dotted over with groups of gold-mining claims. This stretch of country is now known as the Central Manitoba mineral district. In it small gold mills were built and operated for short periods at various times on the Luleo, or Selkirk, Gold Pan, and Elora (Kingfisher) properties; and on the Penniac property considerably to the south of it, at Star lake, in the Boundary district; but the first mill in southeastern Manitoba, or, for that matter, in the whole province, to maintain a steady output on a large scale was that of Central Manitoba Mines, Limited, which started producing in 1927.

The next gold-bearing district to come into prominence in Manitoba is that commonly spoken of as The Pas mineral belt, which is situated in the southwestern corner of territory added to the province in 1912. Some prospecting was done in this district in 1905, but it was not until gold-bearing quartz veins were found at Amisk lake in the contiguous part of the province of Saskatchewan, in 1913, that any very active interest was taken in the mineral possibilities of the region. In 1914, gold-bearing quartz veins were discovered on the shore of Wekusko (Herb) lake at the eastern end of the district, in Manitoba, and a period of active prospecting began in that part of the field, further finds being made at Elbow lake, Copper lake, and other points west of Wekusko lake. In the summer of 1915, large auriferous copper-zinc deposits were found at Flinflon lake, and in the autumn of the same year at the Mandy mine on Schist lake, near each other at the western end of the district. The first stakings on the Sherritt-Gordon deposits, on Kississing lake, 30 miles to the north, were not

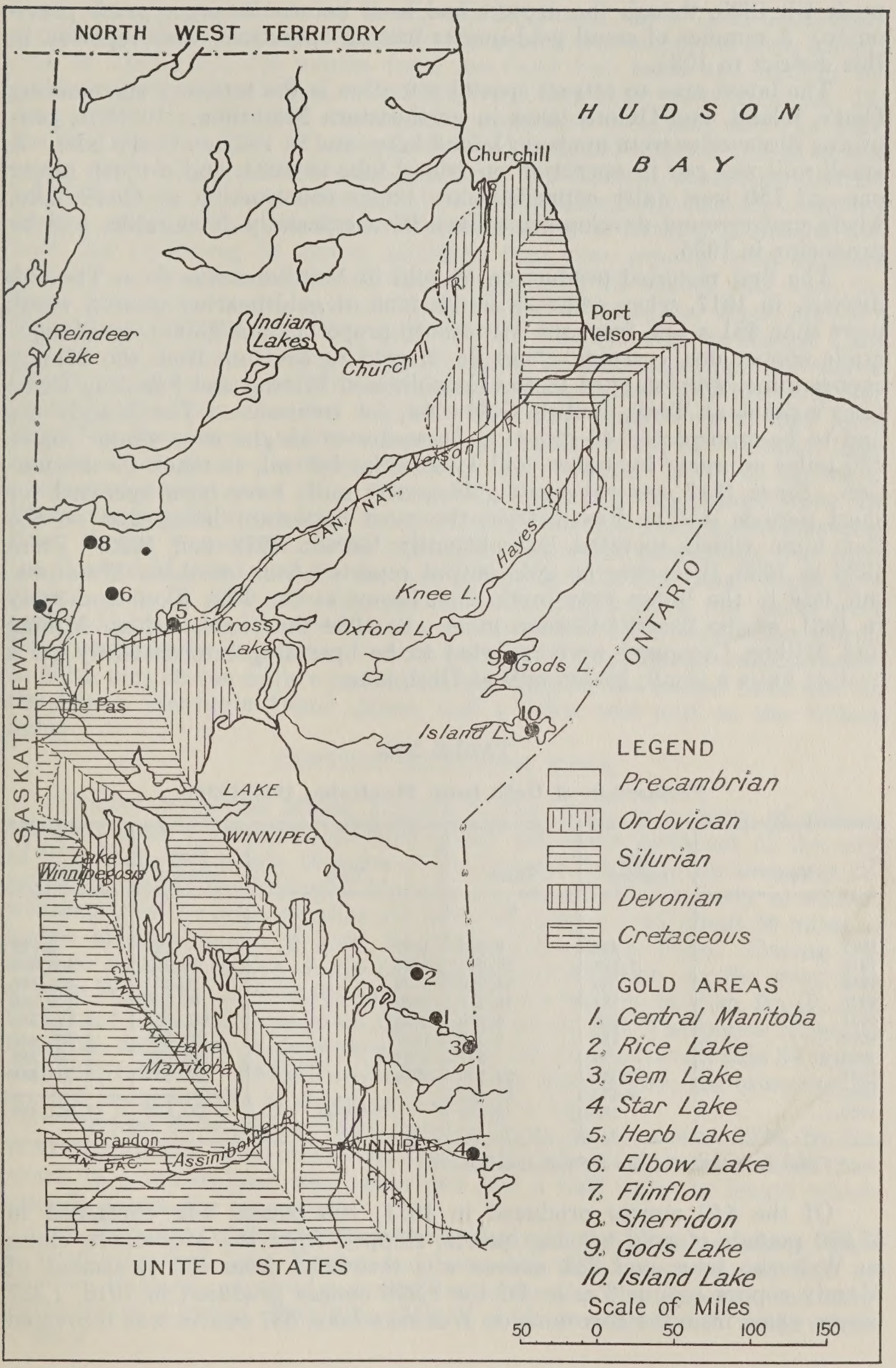
NORTH WEST TERRITORY
HUDSON
BAY
Churchill
Port Nelson
Reindeer Lake
Indian Lakes
Churchill
R.
Nelson
R.
CAN. NAT.
Hayes
R.
Knee L.
Oxford L.
Cross Lake
Gods L.
Island L.
ONTARIO
SASKATCHEWAN
The Pas
LAKE
WINNIPEG
Lake Winnipegosis
CAN. NAT.
Lake Manitoba
Brandon
CAN. PAC.
Assiniboine R.
WINNIPEG
C.P.R.
UNITED STATES
1
2
3
4
5
6
7
8
9
10
LEGEND
Precambrian
Ordovican
Silurian
Devonian
Cretaceous
GOLD AREAS
1. Central Manitoba
2. Rice Lake
3. Gem Lake
4. Star Lake
5. Herb Lake
6. Elbow Lake
7. Flinflon
8. Sherridon
9. Gods Lake
10. Island Lake
Scale of Miles
50
0
50
100
150

Figure 3. Key map of gold-bearing areas in Manitoba.

made till 1923, though the deposit had been known for some years previously. A number of small gold-quartz mining operations were reported in this district in 1934.

The latest area to attract special attention is the territory surrounding God's, Island, and Oxford lakes in northeastern Manitoba. In 1931, promising discoveries were made on Island lake; and in 1932 on God's lake. A small mill was put in operation on Island lake in 1934, and a much larger one—of 150 tons daily capacity—now under construction at God's lake, where underground developments have been especially favourable, will be producing in 1935.

The first recorded production of gold in Manitoba was from The Pas district, in 1917, when some 28 or 29 tons of gold-bearing quartz, worth more than $81 a ton, from the Moosehorn property, and 3,300 tons of high-grade copper ore, carrying about $5 in gold to the ton, from the Mandy copper mine, were shipped to the Consolidated Mining and Smelting Company's plant at Trail, British Columbia, for treatment. The Mandy ore had to be transported 40 miles on horse-drawn sleighs over winter roads, 130 miles on scows by water, and 1,300 miles by rail, to reach its destination. Since 1917, several small gold-quartz mills have been operated for short periods in The Pas district, the most important being that on the Rex mine which operated intermittently beween 1918 and 1926. From 1926 to 1930, there was no gold output reported from northern Manitoba, but late in the latter year production began at the Flin Flon, and early in 1931, at the Sherritt-Gordon mine. In 1934 the North British Mining and Milling Company were reported to be operating intermittently on a custom basis a small, 10-ton mill at Herb lake.

TABLE XIX

Production of Gold from Manitoba, 1917-1934*

Year	Fine ounces	Value	Year	Fine ounces	Value
		$			$
1917	440	9,095	1927	182	3,762
1918	1,926	39,814	1928	19,813	409,571
1919	724	14,966	1929	22,455	464,186
1920	781	16,145	1930	23,189	479,359
1921	207	4,279	1931	102,969	2,128,558
1922	156	3,225	1932	122,507	2,532,444
1923	31	641	1933	125,310	2,590,388
1924	1,180	24,393	1934	132,321	2,735,318
1925	4,424	91,452			
1926	188	3,886	Total	558,803	11,551,482

* From Dominion Bureau of Statistics Reports.

Of the 440 ounces produced in 1917, 108 ounces was contained in 57,000 pounds of gold-bearing quartz, shipped from the Moosehorn claim on Wekusko lake, and 332 ounces was recovered from the treatment of Mandy copper ore, at Trail. Of the 1,926 ounces produced in 1918, 1,337 ounces came from the Rex mine on Wekusko lake, 537 ounces was recovered from Mandy copper ores at Trail, and 52 ounces came from Moosehorn ore treated in the Rex mill. In 1919, 611 ounces was recovered from Mandy ores at Trail, and 113 ounces from the Gold Pan mine and mill in the Central Manitoba district. In 1920, the Rex mine accounted for 181 ounces, the remaining 600 ounces being contained in Mandy ore. In 1921, the Rex mine produced 87 ounces; the Gold Pan, 101 ounces; and 52 ounces came, probably, from other properties in the Central Manitoba district. In 1922, about 100 ounces was produced by the Kingfisher Mining Company from a small mill on the Elora fractional claim in Central Manitoba district, the remaining 56 ounces produced that year coming from northern Manitoba. In 1923, of the 31 ounces produced, 23 ounces was from the Gold Pan property in central Manitoba; the remainder from northern Manitoba. In 1924, the Rex mill, in The Pas district, produced 1,131 ounces; the Selkirk Mining Company's mill on the Luleo mine in central Manitoba, 45 ounces; and the remaining 4 ounces came from the Gold Pan property and from The Pas district. The total production in 1925 came from The Pas district; 4,386 ounces from the Rex mine, on Wekusko lake, and 38 ounces from the Webb claims on Elbow lake. In 1926, the whole production again came from the northern district; 128 ounces from the Bingo mine on Wekusko lake, the remaining 60 ounces from various properties. In the years 1927, 1928, and 1929, the entire production was from the Central Manitoba mine. Late in 1930, the Flin Flon mine began producing, and, in 1932, the San Antonio. In 1933, small new mills were reported as being put in operation on the Beresford Lake Gold Mine (formerly Oro Grande) and on the Vanson mine, both in southeastern Manitoba; in 1934, new 50-ton mills commenced operating on the Island Lake and on the Diana (formerly Gem) mines, and a 5-ton test mill on the Wilson mine.

CENTRAL MANITOBA MINE

Central Manitoba Mines, Limited is the owner of a group of claims, covering some 1,500 acres, situated about 125 miles northeast of the city of Winnipeg, and within 10 miles of the Ontario boundary, in township 22, range 16, east of the Principal Meridian. Access to the property in winter, when most of the mine supplies are taken in, is by a road about 55 miles in length which connects it with the railway at Great Falls. During the summer months, freight leaves the railway at Riverton, on the west side of lake Winnipeg, is carried across the lake by boat to English Brook, and thence by boat and portage up the Manigotagan and Wanipigow rivers to the mine, a distance of about 60 miles, about 25 of which is portage by teams and motor trucks. From Lac du Bonnet, on the railway, the mine can be reached by aeroplane in about an hour and a half.

The first development work done on these claims was in 1924, by the WAD Syndicate, who uncovered two major ore-shoots, about 3,500 feet apart, in a mineralized zone some two and a half miles in length which extends across the property.

In 1925, the results obtained, particularly on the Kitchener claim, were so promising that John Taylor and Sons, the well-known mining firm of London, England, acquired a controlling interest in the property, and later incorporated Central Manitoba Mines, Ltd. to operate it under their management. Ore to a gross value of about $1,100,000 having been developed on the Kitchener vein, a 150-ton cyanide mill was built, which started producing late in October, 1927, and has been operating steadily ever since except for a few days in the fall of 1931, when operations were held up as a result of a fire. Mine and mill are supplied with hydro-electric power from the Manitoba Power Company's plant at Great Falls, by a transmission line 43 miles in length. In 1930, John Taylor and Sons withdrew from the management of the property.

Mining operations have been carried on chiefly on the Kitchener claim, on which the main camp, the mill, and the main, or Kitchener, shaft are located. This shaft, from which most of the ore milled has come, is a two-compartment shaft, 390 feet deep, serving four levels, at depths of 125, 200, 250, and 375 feet. From the lowest level two winzes have been sunk to depths of 425 and 520 feet, respectively.

Besides the main shaft, there are several other shafts on the property. The Tene 6 shaft, 3,600 feet east of the main shaft, is a two-compartment shaft, 292 feet deep, with levels at depths of 60, 140, 250 feet, through which ore has been mined from the Tene 6 and Tene 2 claims, leased from the Manitowan Syndicate. Ore from this shaft is hauled to the mill by motor trucks. Sixteen hundred feet east of the Tene 6 shaft, again, a three-compartment shaft has been sunk on the Hope claim, where a mineralized zone has been exposed over a length of about 700 feet.

According to the 7th Annual Report of Central Manitoba Mines, Ltd., for the fiscal year ending April 30, 1934, 47,591 tons of ore was milled during the year, yielding bullion containing 12,108 ounces of gold and 2,337 ounces of silver; and concentrate containing 38 ounces of gold and 413 ounces of silver. Operations during the year, however, were carried on at a loss of $65,762.84; and the total deficit in the profit and loss account at the end of the year was $438,231.18. Work on the Tene 6 and Hope sections of the property was abandoned during the year.

A supplementary statement dated June 30th, 1934, shows an operating profit of $6,963.57—exclusive of depreciation and depletion—for the months of May and June, bringing the total deficit down to $431,267.61. Ore reserves on June 30, 1934, are estimated at 17,836 tons containing 0·324 ounce of gold a ton.

DIANA

The property of Diana Gold Mines, Ltd., formerly known as Gem Lake Mines, Ltd., lies just south of the Manigotagan river, and about 16 miles southeast of the Central Manitoba mine. It includes some 52 claims, totalling 2,080 acres astride the Manitoba-Ontario boundary. There is a winter road to the mine from Great Falls, Manitoba, over which supplies are taken in winter.

The original discovery was made in 1926, on what is known as the Bon group of claims. These, together with a number of other claims, were acquired by Gem Lake Mining Company, Ltd., who did surface work throughout 1927. In January, 1928, the property passed into the hands of Gem Lake Mines, Ltd., and the sinking of a 3-compartment shaft was started on the Bon No. 1 claim about the middle of the year.

In 1931, underground workings had reached a depth of 750 feet, and a total of about 10,000 feet of drifting and cross-cutting had been done on levels spaced at 125-foot intervals. On the 250-foot level, ore having a value of $44.77 a ton in gold over an average width of 3½ feet was drifted on for 146 feet; on the 500-foot level ore carrying $15.05 a ton in gold over a width of 3½ feet, for a distance of 106 feet.

A 10-ton test mill, in which the ore was treated by amalgamation, was put in operation in the fall of 1931, and a gold brick, valued at $9,000 or $10,000, was shipped before the end of the year. In the early part of 1932, however, the Gem Lake Company went into bankruptcy and operations ceased. Early in 1934, Diana Gold Mines, Ltd. acquired the property, reopened the mine, and built a 50-ton mill which went into operation in June, and has since been in steady operation treating about 30 tons of ore a day by amalgamation and blanket concentration. Towards the end of 1934 it was planned to increase capacity and add a cynide plant to the mill.

FLIN FLON MINE

The Flin Flon mine, of the Hudson Bay Mining and Smelting Company, Limited, situated on the Manitoba-Saskatchewan boundary, 91 miles by rail northwest of The Pas, Manitoba, is a copper-zinc mine, the ore from which carries also a small amount of gold that is recovered as a by-product. The rate at which gold is produced at Flin Flon depends, therefore, almost entirely on the rate at which copper and zinc can be profitably produced and sold. At present, it is by far the largest gold producer in Manitoba and, in the aggregate, the amount of gold contained in its known ore-bodies is estimated at about 1,332,000 ounces.

The Flin Flon deposit was staked in 1915, on a weathered gossan outcrop from which gold could be panned, but which was found on further investigation to be primarily a low-grade body of copper, zinc, and iron sulphides. In 1916 and 1917, the property was drilled by parties who held it under option, and the ore-body was thus delimited much as it is known to-day. At that time, however, the deposit was some 70 miles in an air-line from the nearest railway, and as, in addition, the treatment of the ore presented some metallurgical difficulties, there was considerable delay in getting financiers interested in its exploitation. In 1920, an option was taken by the Mining Corporation of Canada, Ltd., and underground development was started to check the results of the diamond-drilling. In 1925, the Mining Corporation succeeded in interesting H. P. Whitney of New York, following which exhaustive experiments were conducted to determine the best method of treating the ore. Early in 1927, a 50-ton pilot mill was built on the property and further extensive tests were made; and at the end of the year the Hudson Bay Mining and Smelting Company, Ltd. was formed to operate the mine.

In January, 1928, the Canadian National Railway started the construction of a branch line, which reached Flin Flon in October. Following the arrival of the railroad, a concentrating mill, an electrolytic zinc plant, a copper smelter, a cyanide plant, etc., were built at the mine. A hydro-electric plant equipped to generate 44,000 horse-power was built at Island Falls on the Churchill river and connected with the mine by a transmission line 58 miles in length. Before the end of 1930, there had been completed and put in operation at Flin Flon a plant estimated to be capable of treating 3,000 tons of ore a day, and of producing 30,000,000 pounds of copper, 50,000,000 pounds of zinc, 60,000 ounces of gold, and 900,000 ounces of silver annually. Estimated ore reserves in the mine at this time amounted to some 18,000,000 tons, carrying 0·074 ounce of gold and 1·06 ounces of silver a ton, in addition to 1·71 per cent copper and 3·45 per cent zinc. It is believed that about one-third, or 6,000,000 tons, of these reserves can be won by open-pit mining.

Actual production in 1931, the first full year of operation, was 31,068,556 pounds of copper, 35,056,199 pounds of zinc, 73,000 ounces of gold, and 702,128 ounces of silver, from 1,090,596 tons of ore averaging 1·94 per cent copper, 3·82 per cent zinc, 0·089 ounce of gold, and 1·09 ounces of silver a ton.

In 1932 production was: copper, 42,158,235 pounds; zinc, 41,736,600 pounds; gold, 82,565 ounces; and silver, 933,983 ounces. Ore mined and milled during the year amounted to 1,439,651 tons averaging 0·085 ounce of gold and 1·13 ounces of silver a ton, 1·98 per cent copper and 3·7 per cent zinc.

In 1933, there was produced: copper, 40,941,102 pounds; zinc, 46,305,736 pounds; gold, 94,745 ounces; and silver, 1,210,666 ounces. Ore milled—two-thirds of it from open-pit mining—amounted to 1,604,869 tons, averaging 1·68 per cent copper; 3·9 per cent zinc; 0·084 ounce gold; and 1·26 ounces silver, a ton.

In 1934, despite the fact that operations were interrupted from June 9 to July 9 by a strike, there was mined—two-thirds of it in open pits—1,477,341 tons of ore, of which 1,463,716 tons averaging 0·095 ounce gold and 1·45 ounces silver a ton, 1·71 per cent copper and 4·4 per cent zinc, was milled; and 7,854 tons averaging 0·095 ounce gold and 1·0 ounce silver, and 3·31 per cent copper was smelted direct. From this Flin Flon ore together with 383 tons of purchased custom ore there was produced 99,334 ounces of gold, 1,335,319 ounces of silver, 37,486,054 pounds of copper and 49,427,280 pounds of zinc.

GOD'S LAKE MINE

The property of God's Lake Gold Mines, Ltd. originally consisted of some 149 claims and fractions having a total area of over 6,400 acres, situated on God's lake in northeastern Manitoba. Later, in order to facilitate development it was decided to split the territory up into smaller units to be operated by subsidiary companies in which God's Lake Gold Mines would hold a controlling interest. The first step in this direction was taken in October, 1934, when Jowsey Island Gold Mines, Ltd. was formed to take over and develop approximately two miles on the western end of the property including the original discovery. In summer transportation to the properties was at first from Selkirk, 18 miles from Winnipeg, by steamer for 300 miles to Norway House, thence a further 180 miles by canoe route. In the fall of 1933 a winter road approximately 130 miles in length was cut from the mine to Ilford, a station at mileage 287 from The Pas on the Hudson Bay railway, over which equipment and supplies are now taken in. There is also aeroplane service from Winnipeg, Norway House, and Ilford.

The pioneer discovery on the property, made in July, 1932, was followed up by trenching and diamond-drilling; but the break-up the following spring caused a suspension of operations and work was transferred to another showing—on the Akers claims—which is the one that has now been developed into the God's Lake mine. After considerable diamond-drilling a shaft was started by hand steel in October, 1933. During the winter of 1933-34 a complete steam-driven mining plant was taken into the property and set up for the purpose of continuing the sinking to a depth of 500 feet. By May 13, 1935, the shaft was over 440 feet deep and levels had been driven at depths of 150 feet and 175 feet; and an aggregate length of 847 feet of ore of an average width of 5·6 feet and carrying an average of 0·49 ounce of gold a ton had been passed through on the first level, and 927 feet, averaging 5·0 feet in width and 0·44 ounce a ton on the second. At the same time three faces, one on the first and two on the second level were still in ore.

In view of the results obtained underground the company have decided to build a mill which it is expected will be in operation by September, 1935. Initial capacity will probably be 100 tons a day but the design will be such that this can be easily and quickly increased as conditions warrant. The company has also acquired control of an hydro-electric power site within 40 miles of the mine and organized a subsidiary—Kanuchuan Power Co.—to develop and operate it. At first it is proposed to develop 1,900 horse-power, but this can be readily increased to 5,000 horse-power if necessary. The Kanuchuan Power Company will supply not only the God's Lake mine but also the Jowsey Island mine and any other subsidiaries of the God's Lake Company that may be formed in the future. It will also be in a position to supply power to independent companies.

ISLAND LAKE MINE

Island Lake Mines, Ltd., controlled by Ventures, Ltd., owns, controls, or has under option 150 mineral claims in the Island Lake area in northwestern Manitoba. The mine can be reached by aeroplane or, alternatively, in winter by a winter road 174 miles long from Norway House at the north end of lake Winnipeg. Freighting of supplies is done by tractor haulage over the winter road.

The main discovery was made on Gold island, one of the Jack of Clubs group of claims in 1931. Diamond-drilling was done in 1932 and 1933 on Gold island and adjoining under-water areas, on what is known as the West Island zone 2,000 feet northwest of Gold island; and on the J. D. group of claims to the east. A two-compartment shaft was sunk to a depth of 32 feet on Gold island in 1932. The results appeared so promising that early in 1933 mining and milling equipment were taken in to the property and during the year the sinking of the shaft was continued to a depth of 260 feet, with levels at 140 feet and 240 feet below the collar, and the milling plant—a 50-ton cyanide mill operated by a 175 h.p. steam engine—was erected.

Underground developments, however, did not prove up the quantity of ore expected from surface indications and the results of the diamond-drilling, so the mill was not put into operation until the spring of 1934. Since then it has been treating such high-grade ore as is available at the rate of 30 or 40 tons a day in order to supply, in part, funds to be used in a search for new ore-bodies. According to a statement by the president of the company at the end of 1934, "The future of the company depends on whether further ore-bodies can be located, as to date no ore has been mined or located below the first level of Gold Island". Bullion recovered in the mill from the time it started in April till the end of November, 1933, is given as approximately $130,000. In addition 300 tons of concentrate were made ready for shipment. It is estimated there is still 2,000 tons of ore available for milling.

SAN ANTONIO MINE

The San Antonio mine, of San Antonio Gold Mines, Ltd., consists of 17 claims and fractions, some 670 acres in total extent, situated on the north shore of Rice lake, 17 miles northwest of the Central Manitoba mine. It can be reached from the railway by the same general routes as the latter.

The San Antonio claims adjoin the Gabrielle, the first claim to be staked for gold in the Rice Lake area, in 1911. Exploratory work was started on them in 1926 by the Wanipigow Syndicate, and in July, 1927, they were taken over by Wanipigow Mines, Ltd., the name of which was shortly after changed to San Antonio Mines, Ltd. In August, 1931, as a result of a reorganization of the company, the name was again changed to San Antonio Gold Mines, Ltd.

Development of the property was carried on through two shafts, the No. 1 shaft on the west side of the San Antonio claim, and the No. 2, or Island, shaft sunk on an island in Rice lake. In 1934, a new central shaft—No. 3—was started and sunk to a depth of 1,074; total development work at the end of the year included: 11,593 feet of drifting; 1,854 feet of shaft sinking; 8,715 feet of cross-cutting; 1,350 feet of raising; and 14,997 feet of diamond-drilling. Ore reserves were increased from 61,090 tons at the end of 1931 to 225,000 tons carrying 0·39 ounce of gold a ton at the end of 1934; notwithstanding that 159,434 tons had been mined in the meantime.

In 1932, a 150-ton cyanide mill was built, the rated capacity of which was increased to 300 a day, in 1934. The first gold was produced in May, 1932; and the first dividend paid in 1934.

Hydro-electric power for operating mine and mill is purchased from the Manitoba Power Company.

TABLE XX

Production Record of San Antonio Mine, 1932-1934*

Year	Ore milled, tons	Gold per ton milled, oz.	Bullion produced**	Premium received	Total value of bullion produced
			$	$	$
1932	30,419	....	259,239 89	33,889 89	293,129 78
1933	55,677	0·43	470,831 25	186,639 41	657,470 66
1934	64,294	0·36	448,928 20	297,884 18	746,812 38

* Compiled from annual reports of San Antonio Gold Mines, Ltd.

** Gold at $20.67 an ounce.

SHERRITT-GORDON MINE

The Sherritt-Gordon mine, the property of Sherritt-Gordon Mines, Ltd., is situated at Sherridon, on Kississing lake, 45 miles north of the Flin Flon mine, and 97 miles from The Pas by rail. Like the Flin Flon, it is essentially a copper-zinc mine in which gold is a by-product. Its known ore-bodies are considerably smaller than those at Flin Flon and carry less gold.

Although the existence of the Sherritt-Gordon deposit had been known for some considerable time previously, it was not until 1926 that active steps were taken for its development. After several different parties, in quick succession, had had it under option, Sherritt-Gordon Mines, Ltd., was incorporated to work it in 1927. A branch of the Canadian National railway reached the mine in July, 1929, following which material and equipment for the erection of a plant designed to handle 500,000 tons of ore a year were brought in. A concentrating mill was built, one unit of which was put into operation about April 1, 1931, producing copper concentrate only, no attempt being made to save zinc. The copper concentrate, which also carries the gold, was sent to Flin Flon where it was smelted, under contract, by the Hudson Bay Mining and Smelting Company. Power for mining and milling was obtained, also under contract, from the Island Falls plant of the same company.

During the nine months from April 1 to December 31, 1931, the Sherritt-Gordon mill treated 214,081 tons of ore, the concentrate from which yielded 14,718,387 pounds of copper, 125,845 ounces of silver, and 4,039 ounces of gold. Early in 1932, owing to the low price and lack of demand for copper the mine was shut down and has not yet been reopened.

The ore reserves in the Sherritt-Gordon mine are found in two main ore zones about 3,400 feet apart, known, respectively, as the east zone and the west zone. The east zone is estimated to contain 866,175 tons of ore, averaging 2·16 per cent copper, 5·78 per cent zinc, and carrying gold to the value of 39 cents a ton; the west zone 3,271,900 tons, averaging 2·90 per cent copper, 2·76 per cent zinc, and gold to the value of 37 cents a ton. All the ore milled was drawn from the west zone.

ONTARIO

In 1934, the province of Ontario produced 2,105,339 fine ounces or almost 70 per cent of all the gold produced in the Dominion in that year; and it has produced nearly 50 per cent of the total recorded Canadian production to date. Approximately 92 per cent of Ontario's production, in turn, is derived from the Porcupine and Kirkland Lake camps—two small areas lying some 65 miles apart in the northeastern part of the province—the first of which furnished 45 per cent and the second 47 per cent of Ontario's production in 1934. Outside the Porcupine and Kirkland Lake camps the largest producing gold mine in Ontario is the Howey mine, in the northwestern part of the province, near the Manitoba boundary. The output of the Howey, together with that of a number of small mines and prospects scattered over the province, and by-product gold from the nickel-copper mines, makes up the remaining 8 per cent of Ontario's present output.

Though there has been continuous production of more or less gold in Ontario for more than forty years, and sporadic production goes back to 1866, gold mining can hardly be said to have been established as a profitable industry in the province before the discovery of the Porcupine goldfield in 1908. Previous to that time the best-known gold-bearing area was the Lake of the Woods district, which was the scene of a gold-mining boom in the eighteen-nineties when three mines, the Sultana, Mikado, and Regina, are reported to have produced gold to the value of between one-half and three-quarters of a million dollars each. This period of activity in the Lake of the Woods district ended in the early nineteen-hundreds, and by 1909 the gold production of the province had dropped to 1,569 ounces, from a previous maximum of 20,394 ounces in 1899.

In addition to new mines that have recently come into production it is significant to record the reopening of many old mines which were producers in the eighteen-nineties and early nineteen-hundreds; a higher price for gold, modern treatment methods, and improved transportation facilities having entirely altered the outlook for many of these old properties within the last few years. Special interest attaches to developments during 1934, in the Little Long Lac, Albany River, and Red Lake areas; and to rich new finds made late in the summer in the Sturgeon River area, east of lake Nipigon. There was also much activity in the old Lake of the Woods and Rainy River goldfields of northwestern Ontario, as well as in the south-eastern part of the province—in old Ontario. In short, it may be said that practically every part of Ontario in which the occurrence of gold has ever been reported received more or less attention during 1934.

In this connexion, a list of gold milling plants—idle, operating, and proposed—taken from the Preliminary Report on the Mineral Production of Ontario in 1934, issued by the Ontario Department of Mines, may be of interest.

TABLE XXI

Gold Milling Plants at Ontario Mines in 1934

Area and Mine	Tonnage idle	Tonnage operating	Proposed tonnage
KIRKLAND LAKE BELT—			
Canadian Reserve (Larder Lake)	500		
Bidgood		100	
Kirkland Gold Belt			100
Toburn		100	
Sylvanite		325	
Wright-Hargreaves		1,000	
Lake Shore		2,325	
Teck-Hughes		1,325	
Kirkland Lake Gold		150	
Macassa		200	
Lucky Cross (Kirkland Gateway)	20		
Barry-Hollinger		100	

TABLE XXI—Conc.

Gold Milling Plants at Ontario Mines in 1934

Area and Mine	Tonnage idle	Tonnage operating	Proposed tonnage
Porcupine Belt—			
Blue Quartz		25	
Croesus	25		
Lakeland	25		
Porcupine Peninsular (Night Hawk lake)	200		
Buffalo-Ankerite		350	
Dome		1,500	
Canusa		25	
Coniaurum		400	
Gillies Lake Porcupine			75
Hollinger		5,000	
Marbuan (March)		200	
McIntyre Porcupine		2,250	
Anglo-Huronian (Vipond)		300	
Paymaster Consolidated		200	
Hayden	40		
North Turnbull		15	
McLaren Porcupine		3	
Matachewan and Shiningtree—			
Ashley		125	
Matachewan Consolidated		100	
Young-Davidson		500	
Churchill			10
Sudbury District—			
McMillan		125	
Lebel Oro (Long lake)			200
Halcrow-Swayze		25	
Michipicoten and Goudreau (Algoma district)—			
Algold (New Goudreau)	50		
Minto		80	
Parkhill		100	
Algoma Summit		25	
Thunder Bay District—			
Northern Empire (Beardmore)		125	
Little Long Lac		200	
J. Bruce McMartin (Dik Dik-Atigogama lake)			10
St. Anthony (Sturgeon lake)		125	
Ardeen (Moss)		200	
North Shores (McKellar-Longworth)		25	
Tashota			50
Patricia—			
Howey (Red Lake)		1,100	
McKenzie-Red Lake			200
J. M. Consolidated		30	
Central Patricia		50	+50
Pickle Crow			100
Casey Summit (Birch lake)		50	
Kenora and Rainy River Districts—			
Golden Star		5	
Saundary		5	
Foley Syndicate		5	
Total	860	18,893	795

All Ontario's production has been of lode gold. No placers of commercial value are known to occur in the province, though alluvial gold in minute quantities has been found in stream and glacial sands at a number of points in northern Ontario. Attempts to work some of these have, however, all ended in failure.

Table XXII which follows, shows the total value of Ontario's gold production and the amounts contributed to it by the Porcupine and Kirkland Lake camps; Table XXIII, the geographical distribution of the mines now producing and the output of each in 1934.

TABLE XXII

Total Gold Production in Ontario, 1866-1934*

Year	Total production	Porcupine		Kirkland Lake		Northwestern Ontario	
	Value *c*	Value *c*	Per cent	Value *c*	Per cent	Value *c*	Per cent
	$	$		$		$	
1866-1891...	*a* 190,258	....	....	....	....	....	....
1892-1909...	*b* 2,509,492	....	....	....	....	....	....
1910...	68,498	35,539	51·8	....	....	....	....
1911...	42,637	15,437	36·2	....	....	....	....
1912...	2,114,086	1,730,628	81·8	....	....	....	....
1913...	4,558,518	4,294,113	94·1	86,316	1·9	....	....
1914...	5,544,979	5,206,006	93·8	114,154	2·0	....	....
1915...	8,501,391	7,462,111	88·6	551,069	6·5	....	....
1916...	10,339,259	9,391,408	90·8	702,761	6·8	....	....
1917...	8,698.735	8,229,744	94·5	404,346	4·6	....	....
1918...	8,502,480	7,767,907	91·4	632,007	7·4	....	....
1919...	10,451,709	9,942,803	95·1	486,809	4·7	....	....
1920...	11,686,043	10,597,572	90·7	1,033,478	8·8	....	....
1921...	14,692,357	13,103,526	89·5	1,524,851	10·4	....	....
1922...	20,579,569	18,374,658	89·3	2,159,581	10·5	....	....
1923...	20,136,287	17,313,115	85·9	2,719,939	13·5	....	....
1924...	25,669,303	22,135,534	86·2	3,446,632	13·4	....	....
1925...	30,206,432	24,733,120	81·8	5,385,256	17·8	....	....
1926...	30,950,753	23,680,670	76·5	7,174,083	23·2	....	....
1927...	33,627,040	23,851,857	70·9	9,674,114	28·7	....	....
1928...	32,629,111	20,246,319	62·0	12,233,524	37·5	....	....
1929...	33,535,226	19,281,286	57·6	14,046,596	41·8	22,988	0·07
1930...	35,886,558	17,758,842	49·9	17,172,770	47·9	461,730	1·30
1931...	43,117,615	19,891,521	46·2	21,734,729	50·4	1,007,756	2·30
1932...	47,284,621	21,422,117	45·2	23,782,313	50·3	1,607,831	3·4
1933...	44,558,514	21,624,617	48·5	20,817,277	46·7	1,352,017	3·0
1934...	43,534,489	19,631,927					
Total...	529,615,960	347,721.377	67·5*d*	166,327,961	30·0*d*	....	....

* Compiled from Ontario Department of Mines Reports.

a Estimated.

b Maximum yearly output was $421,591 in 1899.

c Gold at $20.67 an ounce.

d Per cent of total to end of 1933.

TABLE XXIII

Sources of Ontario's Gold Production in 1934 (*a*)

Area	Ore milled, tons	Gold Bullion Shipped				Total value (Standard)*	Exchange adjustment	Value, Canadian funds
		Gold content		Silver content				
		oz.	$ (Standard)	oz.	$	$	$	$
PORCUPINE								
Anglo-Huronian (Vipond)	101,806	15,541·47	321,271	2,774	1,293	322,564	216,679	539,243
Buffalo-Ankerite	125,134	20,503·16	423,838	1,999	940	424,778	286,054	710,832
Coniaurum	138,114	28,435·54	587,815	4,209	1,977	589,792	389,364	979,156
Dome	547,600	206,157·67	4,261,657	18,939	8,712	4,270,369	2,737,056	7,007,425
Hollinger	1,900,490	434,257·14	8,976,892	108,827	52,595	9,029,487	4,987,770	14,017,257
Marbuan	26,030	3,304·35	68,307	298	147	68,454	44,968	113,422
McIntyre Porcupine	851,345	239,099·32	4,942,620	58,421	27,005	4,969,625	3,319,637	8,289,262
McLaren	50	9·86	204	2	1	205	134	339
Paymaster Consolidated	13,824	2,020·50	41,767	583	303	42,070	27,452	69,522
Miscellaneous	....	48·00	992	....	....	992	664	1,656
Amalgamated Goldfields	500	19·02	393	8	4	397	266	663
Munro-Croesus	....	298·54	6,171	24	13	6,184	4,283	10,467
Total	3,704,893	949,694·57	19,631,927	196,084	92,990	19,724,917	12,014,327	31,739,244
KIRKLAND LAKE								
Argonaut (tailings)	12	54·00	1,116	18	9	1,125	747	1,872
Barry-Hollinger	33,445	4,399·52	90,946	409	193	91,139	60,937	152,076
Bidgood	2,433	199·46	4,123	39	18	4,141	2,663	6,804
Kirkland Lake Gold	64,952	20,316·21	419,973	2,853	1,340	421,313	281,987	703,300
Lake Shore	836,023	472,768·05	9,772,982	101,501	47,614	9,820,596	6,522,028	16,342,624
Macassa	66,557	32,056·45	662,666	3,684	1,726	664,392	446,716	1,111,108
Moffatt-Hall	8,476	2,525·30	52,202	343	163	52,365	35,923	88,288
Sylvanite	111,767	50,336·63	1,040,552	8,298	3,770	1,044,322	532,448	1,576,770
Teck-Hughes	442,745	167,411·82	3,460,709	23,837	11,161	3,471,870	1,888,480	5,360,350
Toburn	36,230	20,400·69	421,720	4,874	2,311	424,031	284,088	708,119
Wright-Hargreaves	354,418	218,203·16	4,510,660	39,962	18,340	4,529,000	3,043,292	7,572,292
Miscellaneous	....	372·83	7,707	33	15	7,722	5,156	12,878
Total	1,957,058	989,044·12	20,445,356	185,851	86,660	20,532,016	13,104,465	33,636,481
MATACHEWAN								
Ashley	43,532	13,181·48	272,485	2,023	941	273,426	183,425	456,851
Matachewan Consolidated	4,680	679·39	14,044	100	52	14,096	9,472	23,568
Young-Davidson	51,842	3,878·11	80,168	1,399	728	80,896	53,615	134,511
Total	100,054	17,738·98	366,697	3,522	1,721	368,418	246,512	614,930
NORTHWESTERN ONTARIO								
Ardeen (Moss)	38,143	5,815·27	120,212	31,796	15,175	135,387	80,707	216,094
Algoma Summit	421	143·80	2,972	14	7	2,979	1,947	4,926
Casey Summit (†)	4,094	887·89	18,354	87	41	18,395	12,278	30,673
Central Patricia	11,536	6,373·15	131,745	577	292	132,037	87,525	219,562
Dikdik	230	1,082·00	22,367	644	309	22,676	14,962	37,638
Duport	25	64·99	1,343	....	....	1,343	899	2,242
Foley	86	86·00	1,778	12	5	1,783	1,199	2,982
Golden Star	260	76·13	1,574	24	11	1,585	1,063	2,648
Howey	481,757	45,985·26	950,600	15,434	7,197	957,797	636,426	1,594,223
J.M. Consolidated	3,443	1,019·09	21,067	621	359	21,426	13,963	35,389
Little Long Lac	5,485	2,456·99	50,790	198	104	50,894	34,586	85,480
Lebel-Oro (Long Lake)	7	36·38	752	3	1	753	503	1,256
McMillan	12,313	1,959·39	40,504	63	31	40,535	26,809	67,344
Minto	22,189	4,912·20	101,544	144	66	101,610	67,691	169,301
Northern Empire	22,507	5,662·57	117,056	860	416	117,472	78,175	195,647
Parkhill	19,431	8,983·81	185,712	407	189	185,901	124,746	310,647
Saundary Syndicate	13	12·62	261	....	....	261	174	435
St. Anthony (ore, dump, tailings)	21,618	3,571·38	73,827	991	491	74,318	48,880	123,198
Total	643,558	89,128·92	1,842,458	51,875	24,694	1,867,152	1,232,533	3,099,685
Total for gold mines‡	6,405,563	2,045,606·59	42,286,438	437,332	206,065	42,492,503	26,597,837	69,090,340
MISCELLANEOUS								
Nickel-copper refining	....	60,369·95	1,247,957	....	....	....	834,526	2,082,483
In ores from Cobalt	....	4·53	94	....	....	....	62	156
Total	....	60,374·48	1,248,051	....	....	....	834,588	2,082,639
Total gold output**	....	2,105,981·07	43,534,489	....	....	....	27,432,425	70,966,914
CALENDAR YEAR 1933								
Porcupine	3,402,632	1,046,091·01	21,624,617	171,437	54,910	21,679,527	8,249,321	29,883,318
Kirkland Lake	1,766,014	990,044·43	20,466,034	166,518	58,062	20,524,096	7,305,041	27,183,859
Matachewan	38,004	16,991·38	351,243	2,375	849	352,092	143,892	495,984
Northwestern Ontario	414,867	65,403·83	1,352,017	68,296	23,046	1,375,063	495,309	1,870,372
Miscellaneous	....	36,987·66	764,603	....	....	764,603	292,874	1,057,477
Total gold output, 1933	5,621,517	2,155,518·31	44,558,514	....	....	....	16,486,437	61,044,951

---

a From Preliminary Report on the Mineral Production of Ontario in 1934 by the Ont. Dept. of Mines.
* This value is based on the old price of gold ($20.671834 per fine ounce).
† According to mine officials the figures represent only the quantity of gold recovered and sold.
‡ Includes silver recovered with gold. ** From all sources, exclusive of silver.

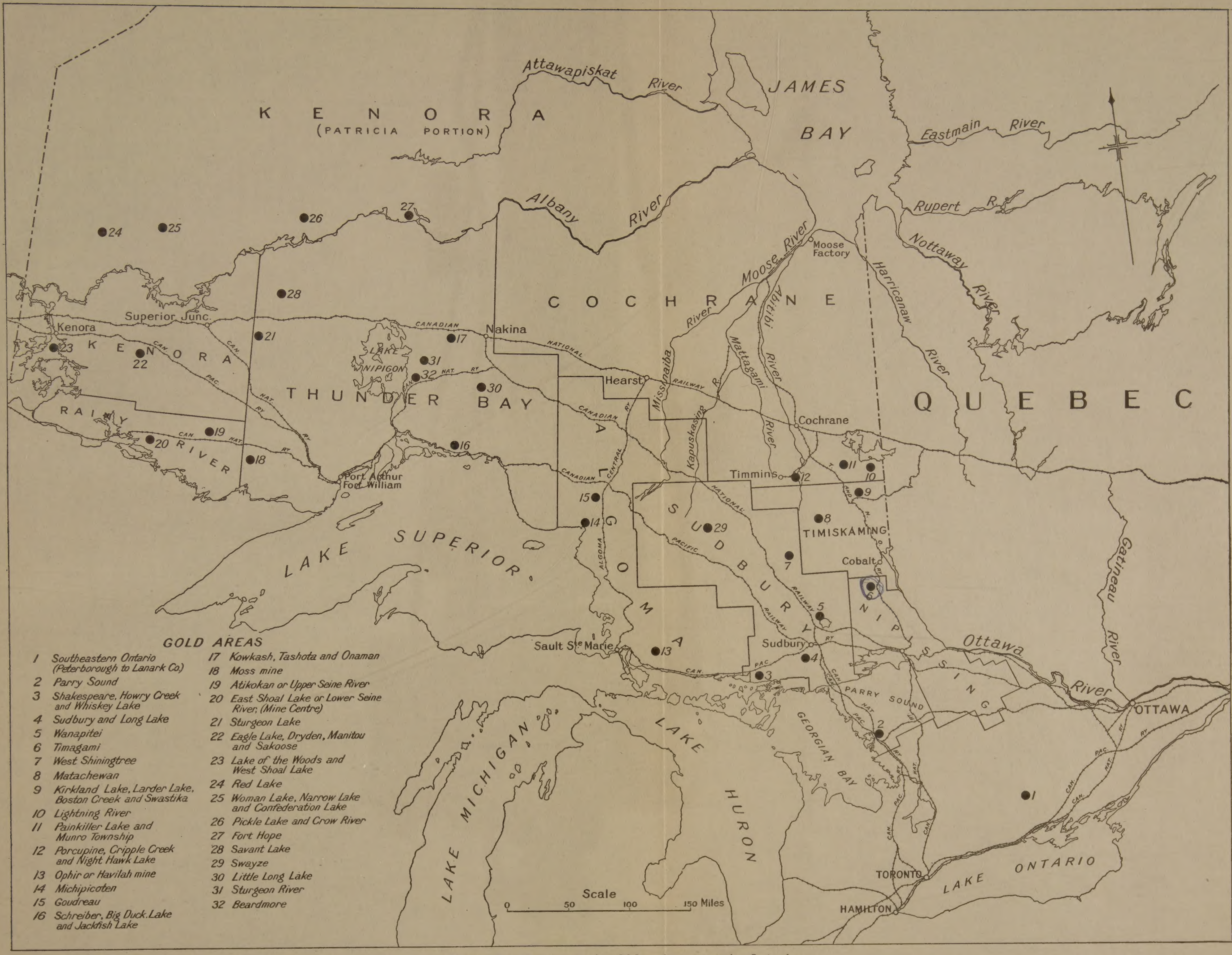
GOLD AREAS
1 Southeastern Ontario (Peterborough to Lanark Co.)
2 Parry Sound
3 Shakespeare, Howry Creek and Whiskey Lake
4 Sudbury and Long Lake
5 Wanapitei
6 Timagami
7 West Shiningtree
8 Matachewan
9 Kirkland Lake, Larder Lake, Boston Creek and Swastika
10 Lightning River
11 Painkiller Lake and Munro Township
12 Porcupine, Cripple Creek and Night Hawk Lake
13 Ophir or Havilah mine
14 Michipicoten
15 Goudreau
16 Schreiber, Big Duck Lake and Jackfish Lake
17 Kowkash, Tashota and Onaman
18 Moss mine
19 Atikokan or Upper Seine River
20 East Shoal Lake or Lower Seine River, (Mine Centre)
21 Sturgeon Lake
22 Eagle Lake, Dryden, Manitou and Sakoose
23 Lake of the Woods and West Shoal Lake
24 Red Lake
25 Woman Lake, Narrow Lake and Confederation Lake
26 Pickle Lake and Crow River
27 Fort Hope
28 Savant Lake
29 Swayze
30 Little Long Lake
31 Sturgeon River
32 Beardmore
KENORA (PATRICIA PORTION)
COCHRANE
THUNDER BAY
KENORA
RAINY RIVER
ALGOMA
SUDBURY
TIMISKAMING
NIPISSING
PARRY SOUND
QUEBEC
JAMES BAY
Attawapiskat River
Albany River
Moose River
Missinaiba
Kapuskasing
Mattagami River
Abitibi River
Harricanaw River
Eastmain River
Rupert R.
Nottaway River
Ottawa River
Gatineau River
LAKE SUPERIOR
LAKE NIPIGON
LAKE MICHIGAN
LAKE HURON
GEORGIAN BAY
LAKE ONTARIO
Moose Factory
Kenora
Superior Junc.
Nakina
Hearst
Cochrane
Timmins
Cobalt
Port Arthur
Fort William
Sault Ste Marie
Sudbury
OTTAWA
TORONTO
HAMILTON
CANADIAN NATIONAL RAILWAY
CAN. PAC. RY
ALGOMA CENTRAL RY
T. AND N. O.
Scale
0 50 100 150 Miles

Figure 4. Key map of gold-bearing areas in Ontario.

THE PORCUPINE GOLD BELT

The Porcupine gold-bearing belt is an area of somewhat indefinite boundaries, situated in northeastern Ontario, about 450 miles due north of the city of Toronto. It is served by the Temiskaming and Northern Ontario railway, through a branch line about 30 miles long, which leaves the main line at Porquis Junction and extends westward to the town of Timmins, the business centre of the district. The chief productive mines lie in an area about three miles wide and five miles long extending east from Timmins, with which they are connected by excellent roads. (See Figure 5.)

Previous to 1909, little attention had been given to the mineral possibilities of what is now known as the Porcupine area, and little was known about them, despite the fact that an old portage route, used by the Hudson Bay Company for over 200 years, crossed the area close to some of the auriferous outcrops. In 1906, some prospectors who had wandered far afield from the Cobalt silver camp did a little work on a quartz vein, on what is now the Hollinger mine, but the results not appearing to be promising, they abandoned it. Two years later, some finely divided gold was found in veinlets of quartz on the shore of Porcupine lake, six or seven miles to the east. In 1909, prospectors, attracted by the find made on Porcupine lake in the previous year, spread over the district, and, within a few days of each other, the discoveries were made which afterwards led to the development of the Hollinger, Dome, and McIntyre mines. Production started on the Hollinger and Dome in 1910 and soon, after some early setbacks due to forest fires, the camp was fairly launched on its prosperous career, the course of which is indicated in the following tables.

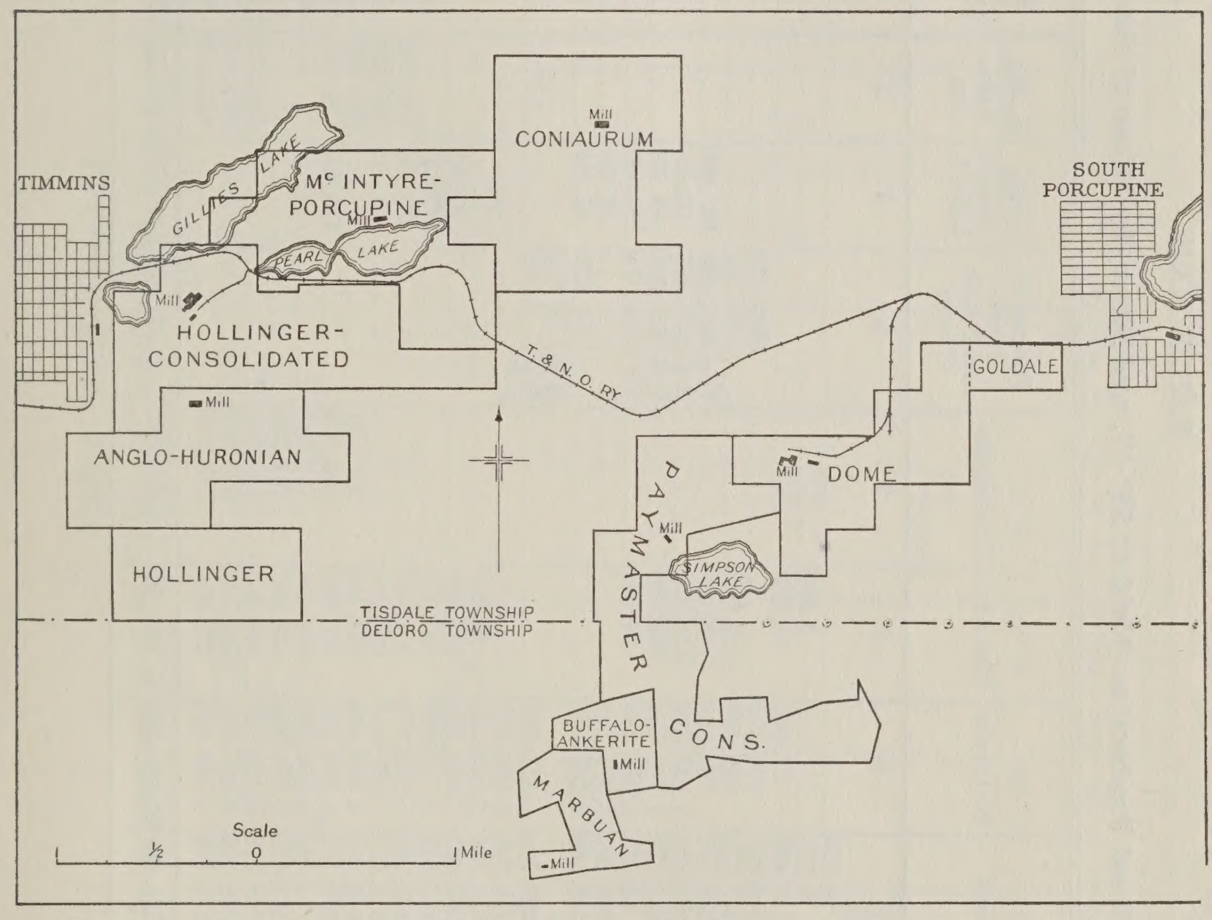
TIMMINS
GILLIES LAKE
Mc INTYRE-PORCUPINE
Mill
CONIAURUM
Mill
SOUTH PORCUPINE
PEARL LAKE
Mill
HOLLINGER-CONSOLIDATED
T. & N. O. RY
GOLDALE
Mill
ANGLO-HURONIAN
Mill
DOME
PAYMASTER
Mill
SIMPSON LAKE
HOLLINGER
TISDALE TOWNSHIP
DELORO TOWNSHIP
BUFFALO-ANKERITE
Mill
CONS.
MARBUAN
Mill
Scale
½
0
1 Mile

Figure 5. Key map of the chief producing gold mines in Porcupine area, Ontario.

TABLE XXIV

Value of Total Production (Gold at $20·67, and Silver) by Mines of the Porcupine Belt, 1910-1934*

Year	Hollinger	Dome	McIntyre	Vipond *a*	Coniaurum	Porcupine Crown and North Crown	West Dome Lake *b*	Buffalo Ankerite *c*	Marbuan (March) *d*	Night Hawk Peninsular	Schumacher	Paymaster	Rea and Newray
	$	$	$	$	$	$	$	$	$	$	$	$	$
1910...	31,194	4,355	....	....	....	....	....	....	....	....	....	....	....
1911...	6,000	4,277	....	5,160	....	....	....	....	....	....	....	....	....
1912...	909,181	737,499	77,657	16,259	....	....	....	....	....	....	....	....	....
1913...	2,488,022	1,242,625	236,299	....	....	Porcupine Crown 326,803	....	....	....	....	....	....	Rea 18,858
1914...	2,719,355	1,059,238	549,166	73,628	....	685,135	....	....	....	....	....	....	125,255
1915...	4,206,015	1,530,287	750,812	246,053	....	602,436	102,880	....	....	....	48,236	....	....
1916...	5,073,401	2,153,820	1,218,073	176,686	....	578,322	16,814	....	....	....	225,301	....	....
1917...	4,261,938	1,480,174	1,710,204	209,738	....	377,904	44,434	....	....	....	198,605	....	Newray 1,447
1918...	5,752,371	82,127	1,578,444	82,868	....	124,474	103,745	....	....	....	92,842	....	1,516
1919...	6,722,266	1,290,301	1,978,014	....	....	....	23,910	....	....	....	....	....	....
1920...	6,219,665	2,020,568	2,223,083	....	....	North Crown 71,529	47,169	....	....	....	....	....	....
						97,301							
1921...	9,051,276	2,290,264	1,827,761	....	....	7,943	....	....	....	....	....	....	....
1922...	12,274,114	4,178,936	2,021,811	....	....	....	....	....	....	....	....	2,800	....
1923...	10,446,412	4,374,144	2,550,129	23,876	....	....	....	....	....	....	....	....	....
1924...	13,433,063	4,307,624	3,604,874	596,803	....	....	60,642	....	....	268,518	....	....	....
1925...	15,749,109	4,365,923	3,721,499	565,379	....	....	287,758	....	....	196,947	....	....	....
1926...	14,829,655	3,940,053	3,862,074	631,636	....	....	220,758	140,588	11,055	111,154	Purchased by the Hollinger in 1922.	63,551	....
1927...	14,539,538	4,031,575	3,965,210	667,724	....	....	35,252	359,005	19,839	166		135,025	....
1928...	10,706,235	3,915,051	4,201,808	694,426	220,534	....	....	289,960	133,879	....		183,271	....
1929...	9,455,290	3,590,537	4,295,491	820,667	635,485	....	155,797	71,684	256,303	....		....	....
1930...	10,260,950	774,943	4,696,578	909,414	738,941	....	15,662	878	306,262	....		....	....
1931...	10,097,975	3,512,066	4,756,880	564,291	751,352	....	....	....	217,586	....		....	....
1932...	10,356,846	4,040,318	5,424,728	454,412	861,031	....	....	219,482	78,835	....		....	....
1933...	9,971,877	4,524,025	5,427,001	502,541	695,957	....	....	462,680	*d*	....		....	....
1934...	9,029,487	4,270,369	4,969,625	322,564	589,792	....	....	424,778	68,454	....	....	42,070	....
Total.	198,591,235	63,721,099	65,647,221	7,564,125	4,493,092	2,871,847	1,114,821	1,969,055	1,092,213	566,885	564,984	426,717	147,076

TABLE XXIV—*Concluded*

Value of Total Production (Gold at $20·67, and Silver) by Mines of the Porcupine Belt—Concluded

Year	Porcupine United	Davidson	Preston and Clifton	Scottish-Ontario	Porcupine Pet	Porphyry Hill	Gold Reef	Tommy Burns	De Santis	Hughes	Miscellaneous	Total value (Standard)
	$	$	$	$	$	$	$	$	$	$	$	$
1910												35,549
1911												15,437
1912												1,740,596
1913						4,200						4,316,807
1914			Preston 15,212		5,000							5,231,989
1915					5,551	2,036	1,547					7,495,853
1916												9,442,417
1917							588	289				8,285,321
1918		15,579										7,833,966
1919		27,089										10,041,580
1920		11,246										10,690,561
1921												13,177,244
1922			Clifton 1,664									18,479,325
1923			8,331								*e* 2,756	17,405,648
1924			5,270									22,266,894
1925												24,886,615
1926									146	30		23,810,700
1927				5,893							*f* 217,350	23,976,577
1928				6,795							*g* 140	20,352,099
1929	44,285										47,701	19,373,240
1930	56,913										61,940	17,822,481
1931	5,439										*h* 36,114	19,941,703
1932				Canusa							*j* 38,940	21,474,592
1933				887					*k* 11,816		*l* 82,743	21,679,527
1934											*m* 7,778	19,724,917
Total	106,637	53,914	30,477	13,575	10,551	6,236	2,135	289	11,962	30	495,462	349,501,638

* From Preliminary Rept. on the Min. Prod. of Ont. in 1934, by the Ont. Dept. of Mines.

a Changed to Anglo-Huronian, Limited, October 16, 1933. *b* Total value of bullion in 1927 was $87,919. Figures shown in above table allow for a deduction of $52,667 due to an erroneous return made in 1925. *c* Formerly Ankerite, and renamed Buffalo-Ankerite in 1932. *d* The March was renamed the Marbuan in 1934; the Buffalo-Ankerite operated the Marbuan mill in 1933, treating the dump of the New York Porcupine. *e* Huddlestone & Cline. *f* Includes "high-grade" recovered from W. P. Wilson. *g* Blue Quartz. *h* Munro-Croesus, $3,955; and miscellaneous, $32,159. *j* Hayden, $1,497; Munro-Croesus, $5,722; J. Spence, $2,515; and miscellaneous, $29,206. *k* Treated in Hayden mill. *l* Hayden, $2,516; New York Porcupine, $3,164; and $77,063 recovered mainly from scrapped machinery, of which J. M. McLaren is credited with $326 on ore shipped to Noranda. *m* McLaren, $205; Munro-Croesus, $6,184; Blue Quartz, $397; and miscellaneous, $992.

TABLE XXV

Dividends and Bonuses Paid by Porcupine Gold Mining Companies, 1912-1934*

Year	[1]Hollinger Consolidated	Anglo-Huronian	[2]Dome Mines	Coniaurum	McIntyre	Buffalo-Ankerite	Total
	$	$	$	$	$	$	$
1912..	270,000	Porcupine	....	....	....	....	270,000 00
1913..	1,170,000	Crown	....	....	....	....	1,170,000 00
1914..	1,170,000	240,000	....	Rea	....	....	1,410,000 00
1915..	1,560,000	240,000	400,000 00	12,000 00	....	....	2,212,000 00
1916..	3,286,000	240,000	800,000 00	....	....	....	4,326,000 00
1917..	738,000	120,000	300,000 00	....	541,542 45	....	1,699,542 45
1918..	1,230,000	....	....	....	543,042 45	....	1,773,042 45
1919..	1,722,000	....	....	....	364,028 30	....	2,086,028 30
1920..	2,214,000	....	416,886 00	....	546,042 45	....	3,176,928 45
1921..	3,198,000	....	478,947 75	....	546,042 45	....	4,222,990 20
1922..	3,198,000	....	715,000 00	....	546,042 45	....	4,459,042 45
1923..	3,198,000	....	1,430,001 00	....	548,542 45	....	5,176,543 45
1924..	3,198,000	....	1,906,668 00	....	774,125 00	....	5,878,793 00
1925..	4,378,800	Vipond	1,906,668 00	....	798,000 00	....	7,083,468 00
1926..	5,805,600	....	1,906,668 00	....	798,000 00	....	8,510,268 00
1927..	6,396,000	67,500	1,191,667 50	....	798,000 00	....	8,453,167 50
1928..	5,412,000	....	953,334 00	....	798,000 00	....	7,163,334 00
1929..	3,198,000	....	953,334 00	....	798,000 00	....	4,949,334 00
1930..	3,444,000	....	953,334 00	Coniau-	798,000 00	....	5,195,334 00
1931..	3,444,000	....	953,334 00	rum	798,000 00	....	5,195,334 00
1932..	3,690,000	....	1,239,334 20	80,923 41	997,499 86	....	6,007,757 47
1933..	4,182,000	....	1,716,001 20	....	1,496,254 57	42,571 29	7,436,827 06
1934..	6,888,000	501,042	3,336,669 00	....	1,596,000 00	89,371 77	13,988,236 95
Total.	72,990,400	1,408,542	21,557,847 15	92,923 41	14,085,162 43	131,943 06	110,266,818 05

* Compiled from Ont. Department of Mines Reports.

[1] Includes $160 paid by Acme in 1915 before amalgamation with Hollinger.

[2] Does not include repayment of $476,607 capital in 1922.

Milling

The extraction process in general use in the Porcupine camp is that known as all-slime cyanidation which is in some cases supplemented by amalgamation. At the Hollinger and McIntyre mines for example all the gold is recovered by cyanidation; at the Dome on the other hand the greater part of the gold is caught on blankets and subsequently extracted from the blanket concentrate by amalgamation, the remainder is recovered by cyanidation. In 1931, the McIntyre introduced the practice of separating the auriferous portion of the ore from the bulk of the gangue before cyaniding, thus greatly reducing the amount of material to be treated with cyanide. This practice, while it has been adopted in some of the newer mills has not become general in the camp. The usual sequence of operations is:

Coarse crushing
Coarse grinding
Fine grinding
Agitation with cyanide solution
Decantation and filtration
Precipitation with zinc dust
Melting and refining

When amalgamation or flotation is used in conjunction with cyanidation, appropriate apparatus for the catching of gold or flotation cells are inserted at suitable points in the mill circuit.

Mining

The Porcupine ore-bodies are vertical, or nearly so, and, as the wall rocks as a rule are strong, shrinkage stoping has been the common method of mining. On the lower levels of the deeper mines, however—on the Hollinger and McIntyre for example—it has been found necessary to change over from shrinkage stoping to filling methods as depth was attained and much of the ore now hoisted in the camp is mined by cut-and-fill.

AMALGAMATED GOLDFIELDS (BLUE QUARTZ) MINE

Amalgamated Goldfields Corporation, Ltd. owns and operates the Blue Quartz mine, a property of which the present extent is about 600 acres, situated on the south shore of Painkiller lake, about 10 miles by road east of the town of Matheson on the Temiskaming and Northern Ontario railway. The main workings are on lot 8, concession V, of Beatty township.

Gold was found in the vicinity of Painkiller lake as early as 1907, following which many claims were staked, but on only a few of these were serious attempts made at development. In May, 1915, Cartwright Goldfields, Ltd. had a shaft down 100 feet on a small quartz vein carrying visible gold telluride and pyrite, on what is now the Blue Quartz mine; they also had a 10-stamp mill on the property, when, in 1916, all the surface plant was destroyed by fire. After the fire nothing further was done till 1921, when Blue Quartz Gold Mines, Ltd. was incorporated to take over the Cartwright property, to which, later, the property of La Santa Lucia Gold Mines, Ltd. was added. Underground work was resumed in 1922 and carried on continuously till June, 1928, when all operations ceased. At this time the shaft had reached a depth of 765 feet and a total of 3,500 feet of lateral work had been done—on six levels. Meantime, early in 1926, a test mill capable of treating about 30 tons of ore a day had been built; but this was operated only for a very short time and the production reported was practically negligible.

The property was idle from 1928 till, in 1933, Amalgamated Goldfields Corporation, Ltd. was incorporated to take it over and work it. The shaft was then unwatered and a 25-ton cyanide mill built in 1933. Production reported in 1934 was 19 ounces of gold recovered from 500 tons of ore milled. The mine was shut down shortly after the middle of 1934, pending re-financing.

BUFFALO-ANKERITE MINE

The property of Buffalo-Ankerite Gold Mines, Ltd. consists of a group of claims in Deloro township, about two miles southwest of the Dome mine.

In 1915 these claims, then the property of the Ankerite Mining Company, Ltd., were taken under option by Coniagas Mines, Ltd. Coniagas Mines after doing considerable development work and spending, it is said, some $400,000 dropped the option in 1918. In November, 1923, the Porcupine Goldfields Development and Finance Company acquired the mine and did further development work; and in 1926 incorporated Ankerite Gold Mines, Ltd., a subsidiary company, to operate the property. A new shaft was sunk to a depth of 620 feet; and a 200-ton mill was built, which went into operation in June, 1926. Milling ceased in May, 1929; and in October of the same year the pumps were drawn and the mine allowed to fill with water, the parent company—Porcupine Goldfields Development and Finance—having gone into voluntary liquidation.

Late in 1932 Buffalo-Ankerite Mines, Ltd. was incorporated to acquire and work the property. Mill capacity was increased to about 350 tons a day and up to the end of the year 55,267 tons of ore had been treated, the bullion recovered having a value of $219,482 exclusive of premium.

When the present company took over the property total development consisted of: 1,302 feet of sinking; 12,696 feet of drifting and cross-cutting; and 986 feet of raising and winzing. The main shaft was 637 feet deep and most of the ore milled had come from above the 475-foot level. At the end of 1933, mine workings had been carried to a depth of 1,050 feet through a winze starting at the 600-foot level. At the end of 1934, ore reserves were estimated at 107,977 tons of positive ore assaying $6.41 a ton and 41,850 tons of broken ore assaying $3.92. In the early part of 1935 the mill was treating 400 tons of ore a day and it was expected that additions to the milling equipment would bring capacity up to 500 tons a day by midsummer.

TABLE XXVI

Production Record of Ankerite Mine

Year	Ore milled, tons	Value of bullion recovered*	Recovery per ton
		$	$
1926	23,060	140,588	6·09
1927	69,863	359,005	5·14
1928	66,606	289,960	4·35
1929	12,912	71,684	5·55
1930	Clean-up	878	....
1931	....	....	....
1932	55,267	219,172	....
1933	111,402	461,869	....
1934	125,134	423,838	....

* Exclusive of premium.

CONIAURUM MINE

The property of Coniaurum Mines, Ltd. covers some 640 acres of mineral lands that adjoin the McIntyre mine on the northeast and presumably includes the easterly extension of the McIntyre vein system. It is a consolidation of three old properties, viz., the Newray, or Rea, the Goldale, and the Armstrong-Booth, all of which were staked in the early days of the camp. At the time of their acquisition by Coniaurum Mines, Ltd., in 1924, both the Newray and Goldale mines had main shafts 1,000 feet deep, and there had been a small production of gold from a 10-stamp mill on the Newray between 1913 and 1918. The Armstrong-Booth property was still undeveloped. In addition to the above, the Canadel claim, contiguous to the southern boundary of the property, was purchased in 1933; and, in 1934, two other claims contiguous to the southern boundary, immediately east of the Canadel, so that the property now includes some 19 claims covering approximately 760 acres.

In July, 1928, a 400-ton cyanide mill had been built and was put in operation. During the following months, however, the profit from the mill was not sufficient to cover the cost of development and in March, 1929, the company went into the hands of a receiver. Later in the year a reorganization was effected by which the property came under the control of Ventures, Ltd., in return for capital supplied to continue development and exploration. Since 1929, the company has shown an operating profit; and a dividend was paid in 1932.

Operations by Coniaurum Mines, Ltd. have been carried on through the old Newray shaft (Bishop shaft) which at the end of 1934 had attained a depth of 3,150 feet. It is planned to continue sinking and establish a new main working level at a depth of 3,500 feet. With this in view a new steel head-frame is being built and a hoist capable of handling 1,500 tons of ore a day from a depth of 3,500 feet is being installed.

TABLE XXVII

Production Record of Coniaurum Mine[1]

Accounting period	Tons milled	Average value per ton	Recovery per ton	Operating costs per ton	Total value[2] recovered	Estimated ore reserves at end of accounting period[3]	
						Tons	Average value per ton
		$	$	$	$		$
Calendar year 1928....	52,005	5·06	4·81	....	249,889 68	....	....
" 1929....	103,293	6·68	6·45	....	666,549 73	70,412	[4]
" 1930....	122,972	6·21	5·99	....	736,727 16	90,610	6·21
" 1931....	130,585	6 26	6 02	4·98	829,970 54	117,172	6 53
" 1932....	144,654	6 08	5 82	5·04	949,254 66	160,927	5 01
" 1933....	145,657	....	4 60	4·06	939,195 02	118,310	....
" 1934....	138,114	....	[5]7 11	5·47	981,850 84	134,133	....

[1] Compiled from the Annual Reports of Coniaurum Mines, Ltd.

[2] Includes premium on U.S. funds.

[3] Broken ore only. On account of the erratic distribution of gold in the veins no numerical estimate of unbroken ore is made.

[4] Approximately of present milling grade.

[5] In Canadian funds.

DOME MINE

The Porcupine property of Dome Mines, Ltd. includes eleven claims covering 438 acres of mineral lands lying about four miles east of the town of Timmins. The original Dome property consisted of five claims, to which there were added later six others previously known as the Dome Extension property.

Spectacular discoveries of gold made on the original Dome claims by J. S. Wilson in 1909 caused the first great rush of prospectors into the Porcupine district. With the exception of some stripping of the surface soil no work was done on these showings, however, until 1910 when they were taken over by Dome Mines Company, Ltd., a company formed in March of that year to develop them. In July, 1911, the erection of a 40-stamp mill had almost been completed when it, together with all the camp buildings, was destroyed in one of the forest fires of that year. A new mill of steel and brick construction, having a rated capacity of about 300 tons of ore a day was completed in March, 1912. In this the method of treatment was to crush the ore first in gyratory crushers, followed by crushing under forty 1,250-pound stamps, the pulp from which was passed over amalgamation plates to Dorr classifiers. It was next reground in tube mills and again passed over the plates and corduroy blankets. The tailing from these last was then treated by cyanidation in the usual way. About 60 per cent of the gold recovered was caught on the plates and blankets, the remaining 40 per cent being recovered in the cyanide plant.

In 1915 or 1916, the Dome Extension property, which adjoined the original Dome claims on the northeast, was acquired, it having become apparent that the pitching ore zone on the Dome claims would pass into those of Dome Extension at depth. In 1923, the name of the company was changed from Dome Mines Company, Ltd., to Dome Mines, Ltd. In the meantime as the mine developed the capacity of the mill was increased till it was capable of treating some 1,500 tons of ore a day. In October, 1929, this mill was destroyed by fire. The present mill, which was built to replace it, went into operation at the end of October, 1930. It also has a rated capacity of 1,500 tons of ore a day, but in its original design stamps and amalgamation were entirely omitted and provision made for recovering the gold by cyanidation only. It was found however that a satisfactory recovery of the gold could not be obtained by cyanide treatment alone, so provision has been made also for the passing of the crushed ore over blankets, on which the coarser particles of gold are caught, and afterwards recovered from the blanket concentrate by barrel amalgamation.

The ore-bodies on the Dome mine occur erratically in the country rock very much like plums in a pudding, consequently they are difficult to find, and when found it is difficult to estimate definitely their extent and value prior to actual mining. Some have been found between two levels, though not encountered in either. In width they vary from 15 to 150 feet; continuous horizontal lengths of 600 feet are not unknown; and they have been followed continuously in depth for as much as 800 feet. Quartz in large masses occurs in some of the ore-bodies—the name of the mine had its origin in large dome-shaped masses of quartz found on surface—but, on the whole, quartz constitutes only 10 or 15 per cent of the ore mined, which consists chiefly of mineralized country work.

The earliest workings on the mine were open pits or "glory holes." These extend on the surface over a length of about 900 feet and a maximum width of 300 feet; and to a depth of over 100 feet. Something over 900,000 tons of ore that yielded approximately $5,000,000 was won in this way. The great bulk of the ore mined, however, has come from shrinkage stopes in underground workings. Development has been chiefly through the No. 3 shaft, which is close to the mill. Exploratory workings have been carried to a depth of over 3,700 feet. In 1932, discoveries of new orebodies were made on the 23rd level, and these are still under development. At the end of 1934, a winze had been sunk to a depth of about 700 feet below the 23rd level in the new ore zone and four new levels driven below it, at intervals of 150 feet, viz., the 24th, 25th, 26th, and 27th. Development to date indicates upwards of 350,000 tons of ore of good grade between the 23rd and 27th levels in this new zone.

TABLE XXVIII
Production Record of Dome Mines, Ltd.[1]

Accounting period	Tons milled	Value per ton	Re-covery per ton	Re-covery, per cent	Operating costs per ton milled	Total[2] value recovered	Estimated ore reserves at end of accounting period		
							Tons	Average value per ton	Gross value
		$	$		$	$		$	$
1910	247	....	....	....	....	4,355 00	....	....	....
1911	[3]	....	....	....	....	4,276 61	....	....	....
Nov. 30, 1911 to Mar. 31, 1913[4]	101,812	....	10 25.	....	4 95	1,043,994 93	566,000	....	....
Apr. 1, 1913 to Mar. 31, 1914	145,303	8 77	8 29	94·51	4 20	1,204,597 64	512,600 2,000,000	4 81 3 50	....
" 1, 1914 " 31, 1915	248,550	4 68	4 25	90·6	2 97	1,055,496 78	2,782,811	4 15	11,576,859
" 1, 1915 " 31, 1916	347,640	5 50	5 12	92·9	2 56	1,778,958 91	2,600,000	6 20	16,120,000
" 1, 1916 " 31, 1917	459,530	5 08	4 73	93·0	2 70	2,171,784 83	2,250,000	5 32	11,979,000
" 1, 1917 " 31, 1918[5]	247,000	4 27	4 17	97·7	2 28	1,030,758 30	1,950,000	5 10	9,945,000
" 1, 1918 " 31, 1919	No ore mined, hoisted, or milled on account of sinking and equipping the No. 3 or Main shaft								
" 1, 1919 " 31, 1920	270,080	6 96	6 57	94·3	3 12	1,773,374 44	3 or 4 years' supply at capacity of plant		
" 1, 1920 " 31, 1921	273,700	7 50	7 11	94·7	4 53	1,946,403 06	"	"	"
" 1, 1921 " 31, 1922	360,000	8 20	7 80	95·1	4 56	2,809,452 38	"	"	"
" 1, 1922 " 31, 1923	363,000	12 12	11 79	97·3	5 25	4,728,935 87	"	"	"
" 1, 1923 to Dec. 31, 1923	320,700	10 68	10 43	97·7	4 66	3,345,477 80	550,000[8]	....	....
Jan. 1, 1924 " 31, 1924	493,400	8 93	8 73	97·8	4 56	4,307,720 04	550,000[8]	....	....
" 1, 1925 " 31, 1925	530,200	8 75	8 55	97·4	4 47	4,366,025 52	620,000[8]	....	....
" 1, 1926 " 31, 1926	555,700	7 28	7 09	97·3	4 17	3,940,090 13	Probably 2 years' supply		
" 1, 1927 " 31, 1927	543,300	7 71	7 42	96·2	4 06	4,031,744 06	500,000[8]	....	....
" 1, 1928 " 31, 1928	548,000	7 47	7 14	95·6	3 85	3,914,883 38	1,250,000	....	....
" 1, 1929 " 31, 1929[6]	452,900	7 88	7 58	96·2	....	3,432,542 99	1,300,000	....	....
" 1, 1929 " 31, 1929	Recovered from ruins of burned mill					157,646 31			
" 1, 1930 " 31, 1930[7]	67,600	6 66	5 89	88·5	4 12	398,063 61	1,900,000	....	....
" 1, 1930 " 31, 1930	Recovered from ruins of old mill					377,202 16			
" 1, 1931 " 31, 1931	542,600	6 94	6 42	92·6	3 48	3,486,505 93	1,920,000	....	....
" 1, 1932 " 31, 1932	536,450	7 92	7 53	95·1	3 88	4,040,317 50	2,000,000	....	....
" 1, 1933 " 31, 1933		*dwt.*	*dwt.*						
	546,500	8·03	7·89	98·2	3 73	6,266,957 14	2,025,000	....	....
" 1, 1934 " 31, 1934	547,600	7·55	7·45	98·6	3 88	7,177,086 48	2,000,000	....	....

---

[1] Compiled from Ann. Repts. of Dome Mines, Ltd.

[2] Includes premium on gold.

[3] Recovered in laboratory.

[4] Milling commenced Mar. 31st, 1912.

[5] Mill shut down for four months.

[6] Mill burned Oct. 28th.

[7] Milling started Dec. 1st.

[8] Broken ore only.

HOLLINGER MINE

The Hollinger mine of Hollinger Consolidated Gold Mines, Ltd. consists of some 560 acres of mineral lands adjoining the town of Timmins on the east. It includes in addition to the original *Hollinger* group, the *Acme, Millerton,* and *Schumacher* groups, and other contiguous claims.

In October, 1909, Ben Hollinger, Jack Miller, and Alex. Gillies staked the claims later known as the Hollinger Gold Mines (4 claims), Millerton Gold Mines (3 claims), and Acme Gold Mines (3 claims). These three adjoining properties together with other adjacent claims were acquired in 1910 by the Timmins-McMartin-Dunlop Syndicate, which was afterwards incorporated as the Canadian Mining and Finance Company, Limited. The Hollinger claims, on which the richest surface showings occurred, were the first to be developed; a two-stamp Tremaine mill being rushed in to this property and put in operation in 1910. A thirty-stamp mill was being built in May, 1911, when a forest fire swept down on the camp and wiped it out completely. A second fire, that swept the whole Porcupine district in July, 1911, prevented work being resumed till the fall of the year. A new mill having a capacity for the treatment of 300 tons of ore a day was completed and put in operation in June, 1912, the process adopted being: coarse crushing, stamping in cyanide solution, tube milling, concentration, with amalgamation of the concentrate, and finally, cyanidation of both the concentrate and the tailing. In 1912, the first dividend was paid by Hollinger Gold Mines, Ltd.; and at the end of 1914 the management was able to announce that some fifty-four veins had been discovered on the property and that ore reserves having a gross value of well over $13,000,000 had been developed.

In 1916, Hollinger Gold Mines, Ltd., Acme Gold Mines, Ltd., Millerton Gold Mines, Ltd., and Claim 13147, all of which were owned or controlled by Canadian Mining and Finance Company, Ltd., were merged under the name of Hollinger Consolidated Gold Mines, Ltd. Up to this time most of the production had come from the Hollinger claim, though a certain amount of Acme ore also had been treated in the Hollinger mill. The Millerton had not yet been developed to the producing state. The Schumacher mine, which under its original owners had produced some gold between 1915 and 1918, was purchased by Hollinger Consolidated in 1922, it having become apparent that veins on the Acme claims would pass into adjoining Schumacher ground at depth.

Between 1912 and 1927, milling capacity was increased from time to time, from the original 300 tons a day to about 8,000 tons a day. The maximum average daily tonnage of ore milled during any one year to date, however, has been 6,001 tons, in 1927. The original ore treatment process of concentration, amalgamation, and cyanidation also was changed to all-slime cyanidation treatment. Stamps were entirely discarded for crushing and replaced by rod and ball mills.

The mine is worked through four main shafts: the Central shaft 3,160 feet deep is used for hoisting ore, waste, and men; the Main and No. 11 shafts, each about 2,750 feet deep, for hoisting men and materials; and the Schumacher shaft, 4,040 feet deep, which serves the eastern portion of the mine. Work has been done on twenty-five levels, the lowest of which—at the Schumacher shaft—is at a depth of 3,950 feet. The total length of mine workings was more than 150 miles at the end of 1932. In 1933, an internal shaft—known as No. 25 shaft—located 100 feet south of the Schumacher shaft, was started on the 3,950-foot level to explore the ground below that horizon and had reached a depth of 4,300 feet at the end of 1934.

According to the company's annual report for 1934, though operations were carried on on all levels from the surface to the 3,950-foot, development work only was done below the 2,750-foot level and 35·8 per cent of the ore milled during the year came from above the 800-foot level.

TABLE XXIX

Production Record of the Hollinger Mine*

Calendar year	Total tons ore milled	Average tons milled per day	Average[2] value per ton	Value[2] per ton left in tailing	Cost per ton	Total[3] value of bullion recovered	Estimated ore reserves at end of year		
							Tons	Average[2] value per ton	Gross[2] value
			$	$	$	$		$	$
1911..	1,000	....	....	....	......	46,082 52	462,000	22 14	10,230,000
1912..	45,195	....	21 44	....	......	933,682 00	644,540	17 48	11,271,400
[1]1913..	138,291	379	18 56	0·723	6 97	2,466,220 24	845,300	13 71	11,604,800
[1]1914..	208,936	584	13 68	0·56	5 21	2,688,354 80	1,162,960	11 49	13,358,420
[1]1915..	334,750	917	10 11	0·40	3 98	3,169,813 84	1,600,800	10 02	16,031,600
1916..	601,854	1,649	8 84	0·40	4 03	5,073,401 25	3,938,540	8 68	34,185,535
1917..	508,139	1,409	8 67	0·31	4 44	4,261,938 72	4,494,510	8 95	30,241,435
1918..	578,755	1,590	10 24	0·30	4 94	5,752,370 87	4,489,080	9 15	40,231,435
1919..	711,882	1,950	9 73	0·33	4 53	6,722,266 81	4,392,680	9 09	39,928,430
1920..	650,205	1,777	9 93	0·38	4 84	6,219,664 80	4,087,083	10 20	41,719,670
1921..	1,072,493	2,938	9 67	0·31	4 87	10,031,050 57	4,392,917	9 72	42,716,027
1922..	1,491,381	4,097	8 53	0·30	4 25	12,274,114 77	4,608,223	9 39	43,269,996
1923..	1,366,352	3,764	7 93	0·29	4 86	10,446,412 20	6,337,742	8 97	56,861,936
1924..	1,659,475	4,559	8 39	0·30	4 46	13,429,226 87	6,518,393	9 10	59,304,885
1925..	1,929,988	5,317	8 51	0·33	4 06	15,786,405 04	7,190,555	9 05	65,068,799
1926..	1,932,559	5,295	7 99	0·35	3 95	14,780,636 60	7,779,234	8 49	66,081,733
1927..	2,178,329	6,001	6 96	0·28	3 45	15,548,899 71	7,432,899	8 10	60,225,539
1928..	1,778,470	4,982	6 28	0·26	4 04	10,712,821 69	6,557,322	7 81	51,210,235
1929..	1,549,157	4,268	6 33	0·24	3 95	9,433,767 14	6,360,021	7 52	47,819,398
1930..	1,625,868	4,479	6 55	0·24	4 02	10,263,504 75	6,615,193	7 38	48,806,685
1931..	1,640,705	4,520	6 39	0·24	4 23	10,528,864 53	6,236,887	7 41	46,241,688
1932..	1,754,863	4,834	6 16	0·24	4 17	10,394,408 89	6,049,548	7 52	45,492,076
1933..	1,727,102	4,758	8 26	0·28	4 19	13,778,683 49	6,487,559	7 47	48,430,451
1934..	1,900,490	5,236	7 68	0·32	3 93	15,080,450 30	7,061,926	7 28	51,440,260

* Compiled from the company's annual reports.

[1] Exclusive of Acme ore treated.

[2] Gold at $20.67 an ounce.

[3] Gold at $20.67 to 1933. For 1933 and 1934, value is in Canadian funds and in 1934 also includes Dominion Bullion Tax of $1,091,626.26.

McINTYRE MINE

The McIntyre mine of McIntyre-Porcupine Mines, Ltd. consists of some 626 acres of mineral lands in a single block surrounding and including Pearl lake and lying immediately northeast of the property of Hollinger Consolidated Mines. In addition to the original McIntyre claims it now includes properties formerly known as the Pearl Lake, McIntyre Extension, Jupiter, Plenaurum, and Platt Veteran.

The first discovery of gold on the original McIntyre claims was made by Alex. (Sandy) McIntyre in the fall of 1909, on the south shore of Pearl lake, not far from the original Hollinger discovery, which was made only a short time before. In March, 1911, McIntyre-Porcupine Mines, Ltd., was incorporated to acquire the property, and in January, 1917, the McIntyre-Jupiter claims (originally Jupiter Mines, Ltd.) and the McIntyre Extension Mines (originally Pearl Lake Gold Mines, Ltd.) were also acquired, the combined properties being thenceforward worked as one, through connected underground workings. In 1924, the company further increased its holdings in the Porcupine camp by the acquisition of the Plenaurum claims and the Platt Veteran claim, adjoining their previous holdings on the east. In 1912, a 10-stamp amalgamation and concentration mill was built on the south shore of Pearl lake, close to the Hollinger boundary. In 1913, this was replaced by a 150-ton all-slime cyanide mill, which was gradually enlarged as mining operations extended until it had a rated capacity of 1,500 or 1,600 tons of ore a day, when it was dismantled in 1931, having been replaced by an entirely new mill on the north side of Pearl lake, on the Jupiter claims. In the new mill, which has a rated capacity of 2,400 tons of ore a day, a notable departure from previous practice was made by the introduction of flotation machines between the coarse and fine grinding units in the mill circuit. All the valuable portion of the ore, amounting to only about 15 per cent of the original weight, goes into a flotation concentrate and this alone is subjected to further treatment by fine-grinding and cyanidation for the recovery of gold. The flotation tailing goes to waste. In this way, the cost of fine grinding and cyaniding a lot of worthless material is saved; and, as less mill space is required for the same output there is also a considerable saving in carrying charges on mill building and equipment.

The first mining was done on the south side of Pearl lake near the old mill. Later, No. 5 and No. 6 shafts on the northwest side of Pearl lake became the chief centres of underground operations, the ore being carried across Pearl lake to the mill on the south shore by aerial tram. In 1925, underground exploration and development work having indicated that the ore-bearing zone trended to the east and reached great depth on the eastern portion of the property, the sinking of a new central shaft, on the north side of Pearl lake, 2,050 feet east of the old main, or No. 6 shaft, was started in February. This new central shaft—the No. 11 shaft—was completed to a depth of 4,133 feet in March, 1927. It is equipped to hoist 3,000 tons of ore a day; is connected with the old workings by drifts on different levels; and was put in operation in October, 1929. All the plant and offices of the company are now concentrated about the No. 11 shaft on the north side of Pearl lake.

In 1931, a long cross-cut driven 3,000 feet southeast from the No. 11 shaft into Platt Veteran ground on the 3,750-foot level cut ore in what is known as No. 22 vein system, which is entirely separate and distinct from the Pearl Lake ore zone. In 1932, a new internal shaft, No. 12, was started from the 3,875-foot level of the No. 11, or Main shaft, to serve the mine below this horizon. By March 31, 1934, No. 12 shaft had been completed to a depth of 1,710 feet below the 3,875-foot level and levels from it started at 150-foot intervals down to the 5,375-foot level.

TABLE XXX

Production Record of the McIntyre Porcupine Mine[1]

Accounting period	Tons milled	Value per ton	Recovery per ton	Cost per ton	Total value recovered	Estimated ore reserves at end of accounting period		
						Tons	Average value per ton	Gross value
		$	$	$	$		$	$
1912	14,500	7 00	5 25	......	76,166 38	....	....	....
1913	31,979	7 85	7 05	......	225,752 25	....	....	....
January 1/14—March 31/15	85,654	8 87	8 39	......	718,331 71	109,693	7 79	854,436
April 1/15—March 31/16	105,758	7 71	7 38	4 28	779,990 94	201,920	11 12	2,247,128
April 1/16—June 30/17	195,307	10 00	9 55	4 78	1,864,914 28	443,617	11 14	4,943,034
July 1/17—June 30/18	178,327	10 05	9 61	5 15	1,714,258 00	459,276	9 80	4,490,432
July 1/18—June 30/19	179,874	9 78	9 29	5 08	1,671,646 03	433,057	11 00	4,777,324
July 1/19—June 30/20	188,835	11 52	11 02	5 48	2,080,178 44	502,682	11 13	5,595,500
July 1/20—June 30/21	171,916	11 67	11 08	6 33	1,904,326 36	624,422	10 25	6,392,394
July 1/21—June 30/22	193,971	10 69	9 99	6 42	1,937,105 07	718,198	10 37	7,452,467
July 1/22—June 30/23	240,615	9 96	9 35	5 54	2,249,741 63	858,504	9 92	8,514,800
July 1/23—June 30/24	360,140	9 69	9 14	4 96	3,291,178 22	1,167,064	9 70	11,313,816
July 1/24—June 30/25	400,259	9 43	8 86	4 81	3,546,637 52	1,348,283	9 20	12,428,903
July 1/25—June 30/26	460,909	8 72	8 25	4 60	3,804,774 90	1,443,111	9 00	13,038,041
July 1/26—March 31/27	385,409	8 08	7 67	4 15	2,957,060 97	1,675,898	8 43	14,130,220
April 1/27—March 31/28	520,460	8 09	7 66	4 23	3,987,634 94	1,841,215	8 35	15,376,165
April 1/28—March 31/29	538,165	8 24	7 83	4 32	4,212,624 82	2,026,279	8 00	16,179,205
April 1/29—March 31/30	550,495	8 46	8 05	4 42	4,433,626 45	2,345,676	8 30	19,417,424
April 1/30—March 31/31	558,115	8 84	8 30	4 56	4,633,140 73	2,562,465	8 00	20,480,964
April 1/31—March 31/32	655,030	8 00	7 63	4 29	4,997,462 80	2,562,563	7 75	19,859,863
April 1/32—March 31/33	736,300	7 70	7 37	4 16	5,427,211 15	2,605,066	7 70	20,017,000
April 1/33—March 31/34	776,845	7 02	6 73	4 19	5,227,102 39	3,064,138	7 20	22,051,338
April 1/34—March 31/35	862,110	10 23	8 85	4 19	7,622,671 10	3,430,481	6 65	22,815,806

[1] From Annual Reports of McIntyre-Porcupine Mines Ltd., All computations made on the basis of gold at $20.67 an ounce up to the year ending March 31, 1935. For that year all values are figured at the current price of gold except *ore reserves* which are computed on the basis of gold at $20.67 an ounce.

MARBUAN (MARCH GOLD) MINE

The property of March Gold, Ltd. consists of five claims situated in Deloro township, about two miles southeasterly from the Dome mine and adjoining the Buffalo-Ankerite. It has furnished a fairly continuous, if small, production of gold since 1926.

The original claims owned by this company, which was incorporated in December, 1919, were H.R. 823 and H.R. 900. Considerable work was done on H.R. 823 between 1921 and 1923, but, no commercial ore-bodies being found, was discontinued. Meanwhile a fourth claim, H.R. 833, was acquired and in 1924 operations were transferred to it. Early in 1926, two more claims, known as the Maidens-McDonald claims, which adjoin H.R. 833 on the north, were purchased from Coniagas Mines, Ltd. A vertical shaft was sunk on H.R. 833, from which cross-cuts were driven to open up veins on the Maidens-McDonald claims, and this is now the main working shaft on the property. It is 723 feet deep, with the lowest working level at a depth of 675 feet.

In July, 1926, a 200-ton cyanide mill was put in operation. Production, previously intermittent, was continuous from that date to June, 1932, when the mill was shut down owing to lack of funds. In 1933, Marbuan Gold Mines, Ltd. was incorporated to take over the holdings of March Gold, and dewatering of the workings started in December. During 1934, a winze was completed from the 675-foot level to the 1,050-foot, and three new levels were established. The mill was started in July and during the last six months of the year treated 25,715 tons of ore from which there was recovered an average of 0·135 ounce of gold a ton. Mint returns amounted to $113,484 and the half year's operations resulted in a loss of $39,348. On December 31, 1934, broken ore reserves amounted to 12,375 tons carrying an average of 0·182 ounce of gold a ton, and possible ore to 11,867 tons averaging 0·331 ounce a ton.

TABLE XXXI

Production Record of March Gold Mine[1]

Year	Ore milled, tons	Recovery per ton	Value of[2] bullion recovered
		$	$
1926	4,655	2 37	11,055
1927	4,566	4 35	19,839
1928	32,627	4 10	133,879
1929	48,484	5 29	256,360
1930	53,953	5 67	306,266
1931	58,460	3 72	217,586
1932	26,812	2 68	71,901
1933	....	....	....
1934	26,030	....	68,454

---

[1] Compiled from Ontario Department of Mines Reports.

[2] Does not include premium.

PAYMASTER CONSOLIDATED MINE

Paymaster Consolidated Mines, Ltd. is a consolidation of West Dome Lake Mines, Ltd. and United Mineral Lands Corporation, each of which, in turn, was a consolidation of a number of still smaller companies, including West Dome Mines, Standard Gold Mines, Bison Gold Mines, McIntosh Mines, Dome Lake Mining and Milling Company, McLean Gold Mines, United Mineral Lands Ltd., and Premier Paymaster Mines Company. The total holding of the present company aggregating some 2,000 acres in extent is made up of several groups of claims situated for the most part in the townships of Deloro, Tisdale, Whitney, and Cody. The particular group with which this article is concerned forms a solid block covering 600 acres lying between the Dome mine to the northeast, in Tisdale township, and the Buffalo-Ankerite mine to the southwest, in Deloro township. Included in this area are three old producers, namely, the Dome Lake, the West Dome, and the Porcupine Paymaster mines.

The *Dome Lake Mining Company, Ltd.* was incorporated in March, 1911, to work part of lot 6, concession I, Tisdale township. In 1912, four shafts about 300 feet apart had been sunk to depths of 60, 200, 110, and 130 feet, respectively, on the No. 3, or main vein; there was also a 10-stamp mill on the property in which the gold was recovered in part by amalgamation and in part in a concentrate for shipment to a smelter. In 1913, control of the mine passed into the hands of the Temiskaming and Hudson Bay Mining Company, by whom it was worked through a subsidiary—the Dome Lake Mining and Milling Company. The first recorded production from the mill was in May, June, and July, 1913, during which time gold to the value of $19,762 was recovered by amalgamation and $5,607 in concentrates. In 1916, the crushing capacity of the mill was increased to 200 tons a day and a cyanide plant capable of treating 100 tons of ore a day was added. Operation was carried on fairly continuously by Dome Lake Mining and Milling Company up to June, 1920, when all work ceased. The total value of the production during this first period of operation is given as $338,952. When the mine was shut down the main shaft was 625 feet deep and the total lateral work done on various levels amounted to 10,833 feet of drifting and 4,326 feet of cross-cutting.

The *West Dome mine* originally consisted of two claims, once known as the Foster or Hotchkiss claims, which lie immediately west of the property of Dome Mines, Ltd. In 1911, a company known as West Dome Mines Ltd. was operating on the property, when a forest fire in which nearly all the company's employees lost their lives destroyed the plant. At this time there were four shafts on the property, the deepest of which was 125 feet deep. In 1915, the original company was reorganized as West Dome Consolidated Mines, Ltd.; and after a period of idleness work was resumed in March, 1916. In the spring of 1918, 300 tons of ore was sent to the Dome Lake mill for treatment, yielding 119 ounces of gold. In 1922, Dome Lake Mining and Milling Company, Ltd. and West Dome Consolidated Mines, Ltd., were merged under the name Consolidated West Dome Lake Mines, Ltd., the merger including also the west 20 acres of the adjoining Ritchie Veteran claim. On the Dome Lake mine, which had been idle since July, 1920, work was resumed in September, 1922; and the Dome Lake mill after some overhauling and changes in equipment was again put in operation, and was treating about 120 tons of ore a day, in August, 1924. In 1927, there was a reorganization of the company, in which the name was changed to West Dome Lake Gold Mines, Ltd. In January, 1929, the mill, which had been idle since July, 1927, was again put into operation; but underground developments, which by this time had been carried to a depth of 1,325 feet in the Dome Lake workings, proving disappointing all work was stopped and the company went into voluntary liquidation early in 1930. Later in the year it was acquired by Paymaster Consolidated Mines, Ltd., and merged with United Mineral Lands Corporation, holders of adjoining properties.

The *Porcupine Paymaster mine* originally consisted of a group of claims in Deloro township contiguous to the boundary line between Deloro and Tisdale, the principal workings being on claims M.E. 15 and H.R. 908 on lot 6, concession VI, Deloro township, lying immediately south of the West Dome Lake property in Tisdale township. A spectacular gold discovery made on H.R. 908, in 1910, was followed in that and the following year by a little development work done by Standard Gold Mines, Ltd. In January, 1916, the property was taken over by Porcupine Premier Gold Mines, Ltd., and some further work was done between that date and the middle of 1917. From 1917 to 1921, the mine appears to have been idle; but meantime—in 1919—it had been taken over by Porcupine Paymaster Mines, Ltd., a subsidiary of Porcupine Premier Gold Mines, Ltd. Active development started in 1921; and a small test mill was built and put in operation in 1922. In April, 1926, a 350-ton cyanide mill was completed and put in operation. In 1927, Premier Paymaster Mines, Ltd., United Mineral Lands, Ltd., and Porcupine Paymaster Mines, Ltd. were consolidated under the name United Mineral Lands Corporation. In the same year the management, estimating that between 3 and 5 million tons of ore carrying $2.50 to $3.00 a ton in gold had been indicated by six or seven miles of diamond-drilling above the 300-foot level, started to equip the mine for large-scale production. A crushing plant and concentrator capable of handling 1,500 tons of ore a day was added to the milling equipment for the purpose of concentrating the ore before cyaniding. The concentrator was started up in 1928; but the preliminary estimate of the gold content of the ore turned out to have been too high and milling operations were consequently unprofitable. The mill was therefore shut down in November, before the new concentrator had been thoroughly tested. At this time the mine workings had reached a depth of 800 feet. In 1930, United Mineral Lands Corporation was merged with West Dome Lake Mines, Ltd., under the name Paymaster Consolidated Mines, Ltd. The West Dome Lake property is credited with the production of bullion to the value of $1,114,821 from 1915 to 1930; and the Paymaster mine with $384,647 from 1922 to 1928.

Through the merger, effected in 1930, Paymaster Consolidated Mines came into possession of three formerly productive mines and two mills, viz.: the Dome Lake mine with workings 1,325 feet deep; the West Dome, or Heinze shaft workings, near the Dome boundary, 350 feet deep; the Paymaster mine, 800 feet deep; the old 120-ton cyanide mill at the West Dome mine; and the 350-ton cyanide plant and 1,500-ton concentrator at the Paymaster mine. Resumption of active operation, however, did not commence till 1933, when the old Heinze, or West Dome (No. 6) shaft was re-equipped, the workings unwatered, drifting commenced, the shaft deepened to 425 feet, and a new level started at that horizon. In 1934, the Main, or Dome Lake shaft (No. 5) was unwatered and underground work commenced there also; the larger cyanide mill was overhauled and put into production in September treating about 200 tons of ore a day; and the first gold brick was poured on November 5. Ore is being drawn from both No. 5 and No. 6 shafts.

Production from September, 1934, to the end of the year was 2,020·5 fine ounces of gold and 583 ounces of silver from 13,824 tons of ore milled.

Ore reserves were estimated to be, on September 27, 1934:—

35,000 tons carrying $11.00 in gold a ton at No. 6 shaft.
6,000 tons carrying $ 6.00 in gold a ton on dump at No. 6 shaft.
10,000 tons carrying $ 9.00 in gold a ton at No. 5 shaft.

VIPOND (ANGLO-HURONIAN) MINE

The Vipond mine of Anglo-Huronian, Ltd. (formerly of Vipond Consolidated Mines, Ltd.) covers a 320-acre block of mineral lands, lying immediately south of the holdings of Hollinger Consolidated Gold Mines, Ltd. It includes in addition to the two claims constituting the original Vipond property, what were formerly known as the Porcupine Crown, Thompson-Krist, and Inspiration properties.

The gold-bearing veins on the original Vipond claims were among the first discovered in the Porcupine camp. In 1910, Porcupine Gold Mines Company, afterwards known as Vipond Porcupine Mines Company, Ltd., did considerable development work on them and set up a one-stamp Nissen mill by means of which a little bullion was produced before forest fires destroyed the plant in the summer of 1911. A new mill of about 100 tons daily capacity, designed to treat the ore by plate amalgamation after crushing in ball and pebble mills, was completed and put in operation in July, 1912, but was closed down the following October. After eighteen months of idleness, operations were resumed in August, 1914; the milling process in the meantime having been altered to all-cyaniding treatment and the name of the operating company changed to Porcupine Vipond Mines, Ltd. In December, 1916, the property of North Thompson Associated Gold Mines was acquired and a new company known as Porcupine Vipond North Thompson Gold Mines, Ltd., was formed to work the combined properties. The new company continued operations until July, 1918, when the mine was again shut down.

After some four years' idleness, the mine was reopened in 1922 by Vipond Consolidated Mines, Ltd., a subsidiary of the Huronian Belt Company of London, England; and the mill, after being remodelled, was put in operation about a year later—in November, 1923—treating about 160 tons of ore a day. About 1925, the property of Inspiration Gold Mines, Ltd. was acquired, to make room for the disposal of the mill tailing; and in the following year the capacity of the mill was increased to 300 tons of ore a day. In 1927, the adjoining Porcupine Crown and Thompson-Krist properties were acquired. In November, 1933, all the assets and undertakings of Vipond Consolidated Mines, Ltd. were transferred to Anglo-Huronian, Ltd., in exchange for shares in the latter company.

The property is worked through a main shaft 1,450 feet deep; but no ore has been found below the 1,000-foot level. For the company's fiscal year ending July 31, 1932, the mine was operated at a loss; and for the fiscal years 1933 and 1934, only the higher price of gold enabled an operating profit to be shown.

TABLE XXXII

Production Record of Vipond Mine[1]

Accounting period	Tons of ore milled	Average[4] value per ton	Recovery[4] per ton	Operating costs per ton milled	Total[5] value recovered	Estimated ore reserves at end of accounting period		
						Tons	Average value per ton	Gross value
		$	$	$	$		$	$
Previous to 1923	....	....	....	....	808,424 08	....	....	....
Year ending July 31, 1924	29,783	13 53	....	10 60[2]	379,075 51	315,423	....	3,010,347
" " 1925	60,344	10 62	9 66	7 84	582,925 66	250,000	....	2,400,000
" " 1926	64,522	9 74	8 77	7 60	565,995 60	300,000	....	2,475,000
" " 1927	95,799	8 21	7 36	5 76	704,899 87	170,000[3]	....	1,400,000
" " 1928	86,727	8 12	7 46	5 44	646,896 18	116,905	....	890,000
" " 1929	100,540	8 63	7 93	5 15	797,713 78	127,500	8 16	1,040,000
" " 1930	113,329	8 71	7 91	4 80	896,398 00	163,525	8 23	1,346,000
" " 1931	107,290	7 53	6 64	5 77	712,856 46	Not estimated		
" " 1932	102,000	5 13	4 69	5 82	478,021 52	....	....	....
" " 1933	110,962	4 78	4 31	4 80	478,730 90	....	....	....
" " 1934	101,347	....	3 91	5 14	647,015 87	....	....	....

---

[1] Compiled from Ann. Repts. of Vipond Consolidated Mines, Ltd. Does not include production from the Porcupine Crown previous to its acquisition by Vipond Consolidated.

[2] Mill operated only 8 mos. though mining was carried on for the full year, hence costs appear unduly high.

[3] Reduction in reserves in part due to a revision of former estimates.

[4] Does not include premium on gold.

[5] Does not include premium on gold up to and including 1933. Figures for 1934 include premium.

TABLE XXXIII

Production of Chief Mines and Total Production of Porcupine Camp, 1910-1934[1]

Calendar year	Hollinger (including Acme)			Dome			McIntyre			Anglo-Huronian			Porcupine Crown and North Crown			Coniaurum including Rea and Newray			Buffalo-Ankerite			West Dome Lake			Schumacher			Marbuan			Paymaster Consolidated			Miscellaneous			Total			Calendar year
	Ore milled, tons	Produced, ounces		Ore milled, tons	Produced, ounces		Ore milled, tons	Produced, ounces		Ore milled, tons	Produced, ounces		Ore milled, tons	Produced, ounces		Ore milled, tons	Produced, ounces		Ore milled, tons	Produced, ounces		Ore milled, tons	Produced, ounces		Ore milled, tons	Produced, ounces		Ore milled, tons	Produced, ounces		Ore milled, tons	Produced, ounces		Ore milled, tons	Produced, ounces		Ore milled, tons	Produced, ounces		
		Gold	Silver		Gold	Silver		Gold	Silver		Gold	Silver		Gold	Silver		Gold	Silver		Gold	Silver		Gold	Silver		Gold	Silver		Gold	Silver		Gold	Silver		Gold	Silver		Gold	Silver	
1910	813	1,733	....	247	214	19	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1,060	1,947	19	1910
1911	(2)	300	....	(3)	207	....	....	....	....	Porcupine Vipond 432	258	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	432	765	....	1911
1912	45,195	43,690	9,756	75,088	35,515	5,448	14,500	3,742	579	5,168	778	277	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	139,951	83,725	16,060	1912
1913	140,131	119,618	26,494	131,149	59,912	7,076	29,669	11,349	2,936	....	....	....	Porcupine Crown 19,715	15,750	2,173	Rea 2,456	909	106	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	(4) 25	210	....	323,145	207,748	38,785	1913
1914	211,846	130,853	26,214	221,390	51,026	8,400	62,284	26,398	7,434	9,700	3,552	414	40,857	33,020	5,049	11,607	6,032	469	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	(5) 503	986	....	558,187	251,867	47,980	1914
1915	441,236	202,606	38,393	317,740	73,726	12,390	101,955	36,094	9,735	35,889	11,871	1,387	46,419	29,032	4,458	....	....	....	....	....	....	11,728	4,949	854	9,240	2,324	342	....	....	....	....	....	....	(6) 139	491	52	964,346	361,093	67,611	1915
1916	601,854	244,140	41,237	444,900	103,809	17,689	136,489	55,756	12,600	43,041	8,509	1,255	51,273	27,877	3,927	....	....	....	....	....	....	6,542	871	45	46,463	10,844	1,701	....	....	....	....	....	....	....	....	....	1,330,562	451,806	78,454	1916
1917	514,301	204,810	34,886	359,570	71,193	10,659	175,893	81,827	17,536	Porcupine Vipond North Thompson 34,971	10,416	1,705	39,111	18,180	2,637	Newray 340	70	9	....	....	....	16,388	2,166	176	37,323	9,551	1,491	....	....	....	....	....	....	(7) 31	44	1	1,177,928	398,257	69,100	1917
1918	578,755	276,045	47,851	Clean-up	3,948	576	176,976	75,556	16,961	15,134	3,977	687	10,907	5,979	941	401	73	9	....	....	....	12,229	5,013	495	19,098	4,463	661	....	....	....	....	....	....	(8) 2,537	752	35	816,037	375,806	68,216	1918
1919	711,882	322,022	60,441	187,580	61,893	9,421	185,018	95,039	20,462	....	....	....	....	....	....	....	....	....	....	....	....	4,433	1,157	....	....	....	....	....	....	....	....	....	....	(8) 3,831	1,208	80	1,092,744	481,319	90,404	1919
1920	650,205	298,223	55,803	295,220	97,023	14,779	191,032	106,527	21,706	....	....	....	6,220 North Crown 11,678	3,434 4,676	801 514	....	....	....	....	....	....	4,707	2,264	334	....	....	....	....	....	....	....	....	....	(8) 3,003	478	35	1,162,065	512,625	93,972	1920
1921	1,072,493	435,404	80,911	335,680	110,316	15,628	172,287	87,837	20,321	....	....	....	....	382	69	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1,580,460	633,939	116,929	1921
1922	1,491,381	590,386	104,444	368,400	201,124	29,250	217,208	97,229	17,711	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	(9) 214	44	2,076,989	888,953	151,449	1922
1923	1,366,352	502,680	86,058	399,800	210,610	31,138	291,428	122,528	28,721	Vipond Consolidated 2,623	1,149	182	....	....	....	....	....	....	....	....	....	....	....	....	Acquired by Hollinger in 1922			....	....	....	....	....	....	....	(10) 540	48	2,060,203	837,507	146,147	1923
1924	1,659,476	645,965	120,223	493,400	207,277	33,666	390,497	173,193	39,118	52,301	28,704	2,696	Merged with Vipond Consolidated in 1927			....	....	....	....	....	....	8,114	2,929	331	....	....	....	....	....	....	....	....	....	(11) 38,326	12,680	2,716	2,642,114	1,070,748	198,750	1924
1925	1,929,988	757,306	137,221	530,200	210,051	34,794	419,640	178,556	46,515	61,294	27,244	3,614	....	....	....	....	....	....	Ankerite			35,278	13,582	1,345	....	....	....	March Gold			....	....	....	(12) 39,778	9,460	2,019	3,016,178	1,196,199	225,508	1925
1926	1,932,559	713,421	134,841	555,700	189,632	32,773	498,653	185,685	41,901	79,717	30,452	3,519	....	....	....	....	....	....	23,060	6,785	588	36,946	11,627	1,748	....	....	....	4,655	533	110	....	....	....	(13) 49,653	8,438	1,381	3,180,943	1,145,573	216,861	1926
1927	2,178,329	699,657	134,604	543,300	194,200	29,993	522,880	190,562	45,525	90,863	32,189	4,090	....	....	....	....	....	....	69,863	17,318	1,797	(14) 16,982	1,985	568	....	....	....	4,566	957	100	....	8	2	(15) 62,189	17,244	2,890	3,488,972	1,154,120	219,569	1927
1928	1,778,470	515,233	95,996	548,000	188,626	27,348	524,695	201,842	50,634	88,896	33,465	4,566	....	....	....	52,005	10,634	1,220	66,606	13,986	1,458	....	....	....	....	....	....	32,627	6,460	599	....	....	....	(16) 94,305	9,170	666	3,185,604	979,416	182,978	1928
1929	1,549,157	455,094	91,474	452,900	173,042	25,568	550,100	206,628	46,727	108,225	39,569	5,152	....	....	....	103,293	30,641	3,978	12,912	3,458	355	35,142	7,500	1,406	....	....	....	48,484	12,370	1,165	....	....	....	(17) 5,048	4,430	801	2,865,261	932,732	176,626	1929
1930	1,625,868	494,532	102,542	67,600	(18) 37,416	3,959	565,510	226,266	56,047	114,667	43,883	6,469	....	....	....	122,972	35,664	4,517	Clean-up	42	36	1,413	757	53	....	....	....	53,953	14,794	1,173	....	....	....	(19) 7,815	5,730	1,040	2,559,798	859,084	175,836	1930
1931	1,640,705	487,123	99,402	542,600	169,686	15,540	617,425	229,413	50,686	100,214	27,236	4,524	....	....	....	130,585	36,278	5,110	Buffalo-Ankerite			Merged in Paymaster Consolidated in 1930			....	....	....	58,462	10,514	859	....	....	....	1,955	2,003	545	3,091,946	962,252	176,666	1931
1932	1,754,863	499,648	103,549	536,450	195,111	28,580	723,285	261,725	60,837	107,197	21,940	3,492	....	....	....	144,654	41,581	5,315	55,267	10,602	1,173				....	....	....	26,812	3,474	344	....	....	....	(20) 2,945	1,879	314	3,351,473	1,035,960	203,604	1932
1933	1,727,102	481,279	71,135	546,500	218,485	21,897	754,360	261,529	67,566	107,562	24,245	3,994	....	....	....	145,657	33,596	4,383	111,402	22,343	2,315	....	....	....	....	....	....	Marbuan			....	....	....	(21) 10,049	4,615	147	3,402,632	1,046,091	171,437	1933
1934	1,900,490	434,257	108,827	547,600	206,158	18,939	851,345	239,099	58,421	101,806	15,541	2,774	....	....	....	138,114	28,436	4,209	125,134	20,503	1,999	....	....	....	....	....	....	26,030	3,304	298	13,824	2,020	583	(22) 550	376	34	3,704,893	949,695	196,084	1934

---

[1] Compiled from reports of the Ont. Dept. of Mines (Vol. XXXIII, Pt. II, 1924, *et seq.*)

[2] Tonnage milled and recovery destroyed in forest fire.

[3] Recovered in laboratory.

[4] Porphyry Hill.

[5] Porcupine Pet and Preston.

[6] Gold Reef, Porcupine Pet, and Porphyry Hill.

[7] Gold Reef and Tommy Burns.

[8] Davidson Consolidated.

[9] Clifton-Porcupine and Paymaster.

[10] Clifton-Porcupine and others.

[11] Clifton-Porcupine, and Night Hawk Peninsular.

[12] Night Hawk Peninsular.

[13] Porcupine-Paymaster, P. DeSantis, Hughes Gold Mines, Ltd., and Night Hawk Peninsular.

[14] Adjusted for erroneous return in 1925. True figures for 1927 are: gold, 4,238 ounces; silver, 572 ounces.

[15] Porcupine-Paymaster, 6,512 ounces gold and 734 ounces silver: Scottish-Ontario, 60 ounces gold and 35 ounces silver; and 10,458 ounces gold and 2,121 ounces silver chiefly stolen high-grade recovered.

[16] Paymaster, 8,836 ounces gold and 1,078 ounces silver; Scottish-Ontario, 327 ounces gold, and 77 ounces silver; and Blue Quartz, 7 ounces gold and 2 ounces silver.

[17] The Rochester yielded 2,134 ounces gold and 343 ounces silver of this total.

[18] Includes clean-up from burned mill.

[19] Includes 2,985 ounces gold and 619 ounces silver from high grading; and 2,745 ounces gold and 421 ounces silver from the Rochester mine.

[20] Includes 276·43 ounces of gold and 26 ounces of silver from Munro-Croesus; 121·48 ounces gold and 16 ounces of silver from Triple Lake; the remainder from Hayden and recoveries from scrap machinery, etc.

[21]. Includes 4228 oz. gold and 8 oz. silver from Canusa;
121·6 " 10 " Hayden;
152·7 " 20 " New York-Porcupine;
570·9 " 36 " P. DeSantis;
and 3,726·6 " 73 " J. M. McLaren and other sources.

[22] Includes 10 oz. gold and 2 oz. silver from J. M. McLaren;
19 " 8 " Amalgamated Goldfields;
299 " 24 " Munro-Croesus;
and 48 oz. gold from other sources.

KIRKLAND LAKE GOLD BELT

The Kirkland Lake gold camp proper, of which the town of Kirkland Lake is the commercial centre, is situated on a branch line of the Temiskaming and Northern Ontario railway, some 315 miles in an air line—398 miles by rail—north of Toronto. For statistical purposes the Ontario Department of Mines now includes under the general heading "Kirkland Lake Gold Belt" not only the main productive area but also the outlying areas of Boston Creek, Larder Lake, Swastika, and Matachewan.

At Kirkland Lake all the chief producing mines occur within an area some four miles long and three-quarters of a mile broad—strung out along a single main "break" of ore zone. In order from west to east they are: Macassa, Kirkland Lake Gold, Teck-Hughes, Lake Shore, Wright-Hargreaves, Sylvanite, and Toburn (Tough Oakes-Burnside). The Boston Creek area in which the Barry Hollinger mine is situated is about 10 miles south of Kirkland Lake; the Matachewan area, containing the Ashley, Young-Davidson, and Matachewan Consolidated mines, about 40 miles west; the Larder Lake area, in which is the Argonaut mine, about 15 miles east; and Swastika area, about 4 miles west, at Swastika station on the T. and N. O. railway.

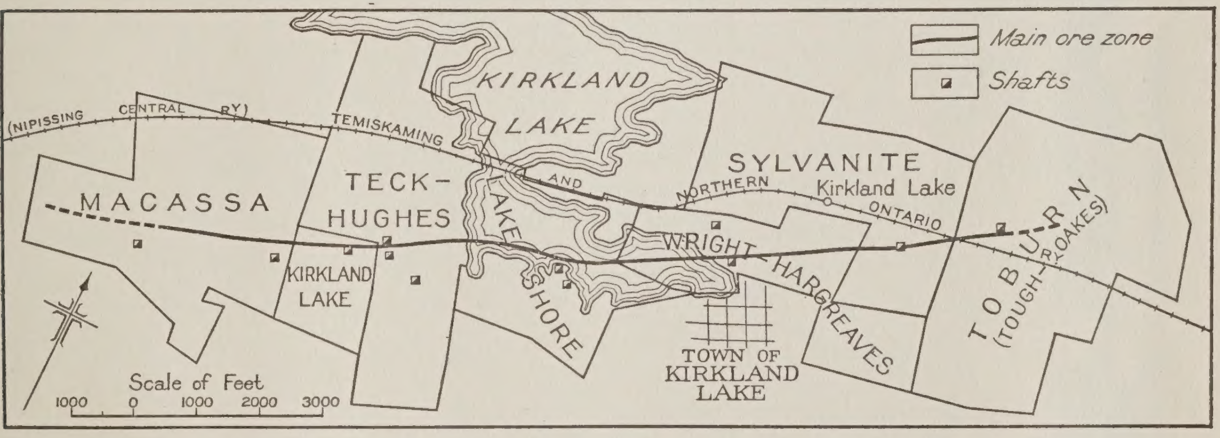
Main ore zone
Shafts
KIRKLAND LAKE
(NIPISSING CENTRAL RY)
TEMISKAMING AND NORTHERN ONTARIO
SYLVANITE
Kirkland Lake
MACASSA
TECK-HUGHES
KIRKLAND LAKE
LAKE SHORE
WRIGHT-HARGREAVES
TOBURN (TOUGH-OAKES)
TOWN OF KIRKLAND LAKE
Scale of Feet
1000 0 1000 2000 3000

Figure 6. Key map of chief producing gold mines of Kirkland Lake area, Ontario.

In 1906, at the time of the silver-mining boom at Cobalt, there was a gold rush to Larder Lake, in the course of which many claims were staked for gold near Swastika, and northeasterly from Swastika to the lake now known as Kirkland lake. These first stakings were for the most part allowed to lapse and it was not until the success attending developments at Porcupine had revived interest in the possibilities of the district that important discoveries were made. In the fall of 1911, W. H. Wright found gold near the shore of Kirkland lake, on what is now part of the Wright-Hargreaves mine, and by the end of the year most of the ground in this vicinity had been re-staked. In January, 1912, gold had also been found three-quarters of a mile northeast of Kirkland lake, on the Tough-Oakes claims. In 1913, two carloads of ore shipped from the Tough-Oakes brought returns of some $17,033. A period of feverish prospecting activity on neighbouring claims immediately set in, resulting in new promising discoveries on the Burnside (now included with Tough-Oakes in Toburn mines), on the Robbins (now the Sylvanite mine), on the Wright-Hargreaves, on the Oakes (now Lake Shore mine), on the Teck-Hughes, on the Wettlaufer (later the Orr and now part of Teck-Hughes mine), on the Wood-McKane (now Kirkland Lake Gold mine), and on the Hunton. Electric power was brought into the camp in 1914; and in the following year the first mill, a 125-ton cyanide mill, was put into operation on the Tough-Oakes. The subsequent rapid development of the camp, which was interrupted by a miners' strike in 1919, is summarized in the following tables.

TABLE XXXIV

Production of Gold and Silver from the Principal Mines of the Kirkland Lake Camp by Mines and Years[1]

Year	Toburn			Wright-Hargreaves			Teck-Hughes			Lake Shore			Kirkland Lake Gold			Sylvanite			Macassa			Totals			Year
	Ore milled, tons	Produced, ounces		Ore milled, tons	Produced, ounces		Ore milled, tons	Produced, ounces		Ore milled, tons	Produced, ounces		Ore milled, tons	Produced, ounces		Ore milled, tons	Produced, ounces		Ore milled, tons	Produced, ounces		Ore milled, tons	Produced, ounces		
		Gold	Silver		Gold	Silver		Gold	Silver		Gold	Silver		Gold	Silver		Gold	Silver		Gold	Silver		Gold	Silver	
	Tough-Oakes[2]																								
1913......	2,220	3,164·05	3,890·40	3	42·77	404·2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2,223	3,206·82	4,294·60	1913
1914......	3,734	5,523·62	6,634·30	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	3,734	5,523·62	6,634·30	1914
1915......	26,196	26,658·23	8,922·00	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	26,196	26,658·23	8,922·00	1915
1916......	39,865	33,991·32	13,051·10	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	39,865	33,991·32	13,051·10	1916
1917......	38,695	16,383·60	5,256·90	....	....	....	11,257	3,181·46	1,154·60	....	....	....	....	....	....	....	....	....	....	....	....	49,952	19,565·06	6,411·50	1917
1918......	22,000	6,619·52	3,006·68	....	....	....	14,774	3,869·29	669·52	16,749	20,031·01	1,188·62	....	....	....	....	....	....	....	....	....	53,523	30,519·82	4,864·82	1918
1919......	....	....	....	....	....	....	18,387	8,156·37	930·10	11,081	12,695·72	932·50	11,324	2,675·05	378·90	....	....	....	....	....	....	40,792	23,527·14	2,241·50	1919
1920......	....	....	....	....	....	....	30,646	11,909·65	1,507·90	19,779	24,291·89	1,723·00	40,812	13,795·13	1,852·90	....	....	....	....	....	....	91,237	49,996·67	5,083·80	1920
1921......	Kirkland Lake Proprietary			36,053	11,909·65	1,507·90	34,693	15,582·00	1,304·50	21,817	23,896·46	2,024·60	43,966	11,677·75	1,665·10	....	....	....	....	....	....	136,529	73,773·71	7,060·60	1921
1922......	16,108	5,144·26	1,870·40	66,181	36,748·21	4,702·30	41,194	28,779·86	2,321·90	24,279	22,737·17	1,974·50	37,489	10,813·64	1,279·20	....	....	....	....	....	....	[3] 198,243	105,189·64	12,434·10	1922
1923......	1,803	579·75	293·80	79,242	36,369·82	4,968·20	38,314	53,954·67	4,074·90	23,203	26,430·57	1,917·70	45,449	10,746·66	1,471·20	....	....	....	....	....	....	188,011	128,081·47	12,725·80	1923
	Tough-Oakes-Burnside																								
1924......	8,438	2,280·81	582·90	84,487	52,464·78	6,412·50	44,209	49,350·06	4,116·90	56,168	53,053·48	4,224·90	8,091	2,235·86	452·50	....	....	....	....	....	....	201,393	159,384·99	15,789·70	1924
1925......	34,152	12,624·56	3,047·00	147,939	92,286·28	8,519·00	55,220	48,076·84	4,518·00	109,273	94,455·57	8,890·00	....	....	....	....	....	....	....	....	....	346,584	247,443·25	24,974·00	1925
1926......	43,871	14,819·25	2,114·00	153,392	103,793·12	8,912·00	80,074	77,266·13	6,450·00	171,197	133,893·00	11,935·00	10,829	6,111·51	1,260·00	....	....	....	....	....	....	459,363	335,883·01	30,671·00	1926
1927......	38,999	7,484·00	752·00	209,164	103,789·86	11,387·00	153,881	134,279·27	11,020·00	236,818	162,829·07	15,652·00	52,648	22,778·47	4,971·00	40,479	20,596·23	6,608	....	....	....	731,989	451,756·90	50,381·00	1927
1928......	14,396	3,967·04	540·00	256,331	88,580·07	12,778·00	317,213	238,887·56	18,453·00	279,661	196,532·92	19,557·00	57,883	19,961·79	3,390·00	69,791	35,452·43	9,263	....	....	....	995,275	583,381·81	63,981·00	1928
1929......	....	....	....	188,238	83,631·42	11,323·00	[4] 337,630	243,744·51	18,733·00	430,170	293,586·51	39,902·00	53,595	16,999·27	2,677·00	74,523	33,167·70	7,242	....	....	....	1,084,156	671,129·41	79,877·00	1929
1930......	....	....	....	220,430	117,454·90	13,090·00	338,555	260,774·69	20,243·00	550,501	377,830·89	69,629·00	52,106	25,763·72	3,526·00	81,213	38,303·45	7,181	....	....	....	1,242,805	820,127·65	113,669·00	1930
1931......	Toburn			266,352	140,520·42	17,759·00	444,410	294,421·57	24,686·00	816,580	533,756·57	113,087·00	52,628	28,314·91	3,317·00	91,621	43,436·60	11,222	....	....	....	1,671,591	1,040,450·07	170,071·00	1931
1932......	14,689	9,840·51	842·00	295,525	171,299·25	25,948·00	475,700	282,882·21	28,800·00	818,698	610,462·59	101,436·00	56,492	25,322·73	3,169·00	96,891	39,919·31	11,499	....	....	....	1,757,995	1,139,726·60	171,694·00	1932
1933......	36,913	23,020·27	3,430·00	285,465	177,189·76	27,372·00	474,700	220,035·99	27,792·00	808,917	499,800·06	95,941·00	49,487	18,465·35	2,332·00	96,937	44,607·50	8,791	8,101	3,682·92	302·00	1,760,520	986,801·85	165,960·00	1933
1934......	36,230	20,400·69	4,874·00	354,418	218,203·16	39,962·00	442,745	167,411·82	23,837·00	836,023	472,768·05	101,501·00	64,952	20,316·21	2,853·00	111,767	50,336·63	8,298	66,557	32,056·45	3,684·00	1,912,692	981,493·01	185,009·00	1934

---

[1] Compiled from reports of the Ont. Dept. of Mines. Includes only mines in Kirkland Lake camp proper, does not include mines in outlying areas, viz., Barry-Hollinger and Gold Hill in Boston Creek area; Argonaut and Associated Goldfields in Larder Lake area; Lucky Cross and Swastika in Swastika area; and Ashley, Young-Davidson, and Matachewan Consolidated Mines in Matachewan area, though these are now included in the Kirkland Lake area for statistical purposes by the Ont. Dept. of Mines.

[2] Production from Tough-Oakes mine was by Kirkland Lake Proprietary, Ltd., in 1922 and 1923. On Aug. 31, 1923, the property was transferred to Tough-Oakes-Burnside Gold Mines, Ltd. The present owners are Toburn Gold Mines, Ltd., incorporated in January, 1931.

[3] Includes production from Ontario Kirkland.

[4] Includes 7,290 tons of tailing re-treated.

TABLE XXXV

Value of Total Production (Gold at $20.67, and Silver) by Mines of the Kirkland Lake Belt, 1913-1934*

Year	Lake Shore	Teck-Hughes	Wright-Har-greaves	Sylvanite	Kirkland Lake	Tough-Oakes Burnside	Barry Hollinger	Argo-naut *a*	Ashley	Macassa	Canadian Assoc'd. Gold-fields	Lucky Cross	Ontario-Kirkland	Swastika and Trout Creek	Total value *b*
	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$
1913....	....	....	1,127	....	....	66,632	....	....	....	....	....	14,006	....	*c* 7,172	88,937
1914....	....	....	....	....	....	117,644	....	5,204	....	....	....	....	....	....	122,848
1915....	....	....	....	....	....	555,539	....	....	....	....	....	....	....	....	555,539
1916....	....	....	....	....	....	711,625	....	....	....	....	....	....	....	....	711,625
1917....	....	66,722	....	....	....	342,831	....	....	....	....	....	....	....	....	409,553
1918....	416,414	80,570	....	....	....	139,683	*d* 10,114	....	....	....	....	....	....	....	646,781
1919....	263,354	169,590	....	....	56,263	....	....	2,631	....	....	....	....	....	....	491,838
1920....	503,735	247,757	....	....	286,901	....	....	26,863	....	....	....	....	....	....	1,065,256
1921....	495,276	322,919	468,751	....	242,417	....	....	513	....	....	....	....	....	....	1,529,875
1922....	471,341	596,495	762,753	....	224,396	107,481	....	....	....	....	....	....	10,082	....	2,172,548
1923....	547,600	1,117,963	754,979	....	223,102	12,174	....	72,512	....	....	....	....	....	....	2,728,331
1924....	1,098,572	1,023,025	1,088,725	....	46,512	47,547	....	152,072	....	....	....	....	....	....	3,456,453
1925....	1,958,720	996,943	1,913,401	....	....	263,064	56,978	214,183	....	....	....	Gold	....	....	5,403,289
1926....	2,775,000	1,601,209	2,150,844	....	126,999	309,709	86,263	143,387	....	....	....	Hill	....	....	7,193,411
1927....	3,375,053	2,781,962	2,151,916	429,424	473,673	153,215	175,692	127,448	....	....	34,595	*e* 865	....	....	9,703,843
1928....	4,073,965	4,948,896	1,838,510	738,146	414,596	82,316	111,767	32,430	....	....	17,700	12,784	....	....	12,271,110
1929....	6,090,189	5,048,420	1,734,728	689,465	352,789	....	151,758	9,959	....	....	....	....	....	....	*f* 14,089,233
1930....	7,836,779	5,398,271	2,432,888	794,459	533,851	....	217,835	1,891	....	....	....	....	....	....	17,215,974
1931....	11,065,618	6,093,199	2,909,837	901,168	586,250	Toburn	224,633	....	....	....	....	....	....	*g* 1,622	*h* 21,783,162
1932....	12,647,128	5,855,570	3,548,161	828,195	524,329	203,642	160,697	....	61,290	....	....	....	....	....	*h* 23,829,480
1933....	10,364,835	4,558,181	3,672,529	925,460	382,515	477,114	60,789	....	351,498	76,262	....	*i* 865	....	....	*j* 20,876,188
1934....	9,820,596	3,471,870	4,529,000	1,044,322	421,313	424,031	91,139	1,125	273,426	664,392	....	....	....	....	*k* 20,900,434
Total...	73,804,175	44,379,562	29,958,149	6,350,639	4,895,906	4,014,247	1,347,665	790,218	686,214	740,654	52,295	28,520	10,082	8,794	167,214,477

---

a Exclusive of copper values. *b* Standard. *c* Swastika. *d* Patricia mine, afterwards called Barry-Hollinger. *e* Samples shipped in 1923 and 1926 by the Gold Hill not heretofore reported. *f* Contains $11,925 miscellaneous. *g* Trout Creek. *h* Includes Telluride in Skead tp., $835 in 1931 and $468 in 1932. *i* Kirkland Gateway in 1933. *j* Includes Atlas, $175; White Rock, $419, and from scrap machinery, $5,546. *k* Includes Bidgood, $4,141; Moffatt Hall, $52,365; Young-Davidson, $80,896; Matachewan Ccnsolidated, $14,096; and miscellaneous, $7,722.

* From Preliminary Rept. in the Min. Prod. of Ont. in 1934, by the Ont. Dept. of Mines.

TABLE XXXVI

Dividends and Bonuses Paid by Kirkland Lake Gold Mining Companies, 1915-1934*

Year	Toburn	Lake Shore	Teck-Hughes	Wright-Hargreaves	Sylvanite	Total
	$	$	$	$	$	$
	Tough-Oakes					
1915	132,875	...	...	...	...	132,875 00
1916	265,750	...	...	...	...	265,750 00
1917	...	...	...	...	...	...
1918	...	100,000	...	...	...	100,000 00
1919	...	100,000	...	...	...	100,000 00
1920	...	80,000	...	...	...	80,000 00
1921	...	120,000	...	...	...	120,000 00
1922	...	80,000	...	412,500	...	492,500 00
1923	...	160,000	...	206,250	...	366,250 00
1924	...	380,000	...	206,250	...	586,250 00
1925	...	600,000	...	550,000	...	1,150,000 00
1926	...	1,000,000	474,714 40	893,750	...	2,368,464 40
1927	...	1,400,000	713,571 60	1,237,500	...	3,351,071 60
1928	...	2,000,000	2,860,286 40	825,000	...	5,685,286 40
1929	...	2,200,000	2,866,286 40	...	...	5,066,286 40
1930	...	3,000,000	2,872,286 40	...	65,590	5,937,876 40
1931	...	4,800,000	3,118,143 60	825,000	131,980	8,875,123 60
1932	...	6,000,000	2,884,286 40	962,500	164,975	10,011,761 40
1933	Toburn	6,000,000	2,884,286 40	1,512,500	164,975	10,561,761 40
1934*a*	148,000	7,000,000	2,643,929 20	3,025,000	824,875	13,641,804 20
	546,625	35,020,000	21,317,790 80	10,656,250	1,352,795	68,893,460 80

* From Ont. Dept. of Mines Repts.

a In addition, in 1934, Macassa paid $131,403.40 and Kirkland Lake Gold $157,173.69, not included in the table.

Milling

The method everywhere employed for the extraction of the gold from the Kirkland Lake ores is all-sliming cyanidation, the different mills differing from each other only in details. Neither stamps nor amalgamation are in use. Coarse crushing of material from the rock-breakers is done in rod and ball mills, or by rolls. Fine grinding is done in cyanide solution in tube mills in closed circuit with classifiers. This is followed by agitation, thickening, counter-current decantation, and precipitation with zinc dust. The precipitated gold is recovered in filter presses, melted down, and refined in bullion furnaces.

The Kirkland Lake ores are, on the average, of considerably higher grade than those of Porcupine but, unlike the latter, a considerable portion of their gold content is very refractory. As a result of this last feature, loss of gold in the mill tailing was unduly high in the earlier days of the camp, but gradual improvements in milling practice have now largely remedied this. Exceedingly fine-grinding is necessary to effect a satisfactory recovery.

Mining

At all the mines at Kirkland Lake entry is by vertical shafts, off which levels are driven at intervals of 100 or 125 feet. As the ore-bearing zone dips at an angle of about 85 degrees, cross-cuts from the levels are necessary to tap the veins. Little timbering is necessary and is largely confined to shafts and levels, though occasionally bad ground is met with that requires special methods for its removal. In general, the width of ore in the stopes is probably about 10 feet, but widths as great as 60 feet are not unknown. Until recently nearly all ore in the camp was extracted by overhand stoping in shrinkage stopes, but shrinkage stoping has now been superseded by cut-and-fill methods on the lower levels of some of the mines.

BARRY-HOLLINGER (FORMERLY PATRICIA) MINE

The Barry-Hollinger mine is a 360-acre property situated about one mile from Boston Creek station on the Temiskaming and Northern Ontario railway and approximately 12 miles south of the Kirkland Lake camp proper.

Development work on this property, then known as the Boston-Hollinger, was started in 1916. In the following year, it was taken under option by the Patricia Syndicate and a 50-ton mill was built to treat the ore by amalgamation and concentration. Crushing was started in June, 1918, but stopped in October, and the property was allowed to revert to the original owners. In July, 1919, the mill and all the surface plant was destroyed by a forest fire. The mine then lay idle till 1923, when Barry-Hollinger Gold Mines, Ltd. was incorporated to acquire the property and work it.

In the spring of 1925, a new 50-ton mill was built to treat the ore by amalgamation and concentration, but in the following year this was converted into a 100-ton all-cyaniding mill. Underground development had been carried down to the 2,250-foot level at the end of 1933.

In March, 1933, the mill was closed down and milling was not resumed till January, 1934. Mine development, however, was continued in the meantime.

TABLE XXXVII

Production Record of Barry-Hollinger Mine[1]

Year	Tons milled	Recovery per ton	Total value[4] recovered
		$	$
Previous			10,082[2]
1925	8,136	7 00	56,978[3]
1926	13,680	6 31	86,263
1927	25,174	6 83	175,692
1928	23,060	4 85	111,767
1929	22,343	6 79	151,758
1930	31,725	6 87	217,835
1931	31,958	7 03	224,633
1932	34,977	4 59	160,697
1933	5,459		60,789
1934	33,445		91,139

[1] From Ont. Dept. of Mines Repts. [2] By the Patricia Syndicate, in 1918.

[3] From 1925 forward, by Barry-Hollinger Gold Mines, Ltd. [4] Does not include premium on exchange.

BIDGOOD MINE

Bidgood Kirkland Gold Mines, Ltd. are the owners of 753½ acres near the centre of Lebel township, about 5 miles east of the town of Kirkland Lake. The present holding includes the old Cambro-Kirkland as well as the original Bidgood property.

The first development work on the Bidgood was done by Bidgood Gold Mines, Ltd., who, in April, 1920, let a contract for the sinking of a two-compartment shaft to a depth of 316 feet, and the driving of 775 feet of drifts and cross-cuts mainly on the 300-foot level. Work was stopped on Nov. 3, 1920; but was resumed about the middle of 1921. By the middle of 1923, when work again ceased, the shaft was 612 feet deep and a certain amount of lateral work had been done on six levels spaced at 100-foot intervals. In November, 1923, Bidgood Consolidated Mines, Ltd. was incorporated to take over the property from the old company, but nothing further was done till May, 1927, when the mine was pumped out and development resumed. In 1928, the old shaft (No. 1) was deepened to 725 feet and a new 3-compartment shaft (No. 2) was started, about three-quarters of a mile east of No. 1. In May, 1929, No. 1 shaft was 850 feet deep and No. 2, 125 feet. Up to this time some short lengths of good ore had been found in the workings but no bodies of payable size had been developed. In June, 1929, the adjoining property of Cambro-Kirkland Mines, Ltd. was acquired; and in March, 1930, operations were suspended for lack of funds. At this time the workings at No. 1 shaft had reached a depth of 1,000 feet through a winze sunk from the 850-foot level. In 1931, No. 2 shaft was deepened from the 125-foot to the 500-foot level; but work again stopped early in 1932 and in December the company went into bankruptcy.

In February, 1933, the property was sold to a syndicate; and in the following month Bidgood Kirkland Gold Mines, Ltd. was incorporated to operate it. At the time the present owners took charge there were three shafts on the property. No. 1, 850 feet deep with a winze to the 1,000-foot level; No. 2, 500 feet deep; and No. 3—the old Cambro-Kirkland shaft, one-third of a mile northwest of No. 1—800 feet deep. In 1934, the workings were dewatered and the construction of a 100-ton cyanide mill was undertaken, the mill being completed and in operation in July, but no production is recorded since September. Since then the mill has been treating ore from the adjoining Moffatt-Hall mine. The total production with which the Bidgood mine is credited for the year is only 199 ounces.

In February, 1935, it was announced that the Premier Gold Mining Company of British Columbia would take over the property and continue development for a period of six months, under agreement with Bidgood Kirkland Gold Mines, Ltd. Later in the year it was announced that the Premier Company had cancelled this agreement.

KIRKLAND LAKE GOLD MINE

The Kirkland Lake mine of the Kirkland Lake Gold Mining Company, Limited, is the second most westerly producer on the "main break," or ore zone, of the Kirkland Lake camp proper, some 1,400 feet in length of the zone lying within the boundaries of the property.

The first discovery of gold on the Kirkland Lake Gold mine, then known as the McKane claim, was made in 1913 by trenching through some twenty feet of soil on the projected strike of the lode on the Teck-Hughes claims to the east, the actual break being covered with drift for practically the full length of the property. The original operators were Kirkland Gold Mines, Ltd., who after sinking a shaft to a depth of about 80 feet, close to the Teck-Hughes boundary, turned the property over to Beaver Consolidated Mines, Ltd. The latter, in November, 1915, incorporated Kirkland Lake Gold Mining Company, Ltd. to continue development. In 1918, a 100-ton cyanide mill was completed and put in operation, production being first recorded in 1919. With the exception of about four months in 1919, when operations were interrupted by a miners' strike, production was continuous till the end of April, 1924. At that time operations had become unremunerative through the exhaustion of the known ore-bodies, and the mill was closed down. Exploration to depth, with the expectation of finding extensions of the rich Teck-Hughes ore-bodies, was next undertaken, on the advice and under the direction of J. B. Tyrrell. This expectation was realized. Good ore was encountered at a depth of about 2,100 feet, and the mill, which now has a capacity of about 170 tons of ore a day, was started up again in October, 1926, since when it has been in continuous operation. Mine workings at the end of 1934 had reached a depth of 5,885 feet, at the bottom of No. 2 winze.

Hoisting is done in two stages, a central 3-compartment shaft extending down to the 2,475-foot level, below which a four-compartment winze extends to the 4,900-foot level. Below the 4,900-foot level another winze known as No. 2 has been sunk to the 5,885-foot horizon and levels started from it at depths of 5,050, 5,325, 5,450, 5,600, 5,725, and 5,850 feet. Work was discontinued on the lowest levels during 1934 in order to concentrate, for the time being, on intensive exploration on the upper levels.

An emergency exit on the 5,200-foot level connects the mine with Teck-Hughes, to the east; and another, on the 2,475-foot level with the Macassa mine on the west.

TABLE XXXVIII

Production Record of Kirkland Lake Gold Mine*

Accounting period	Tons milled	Average value recovered per ton	Recovery	Costs per ton milled	Total value recovered
		$	per cent	$	$
Calendar year—1919	11,324	4 97			56,263
1920	40,812	7 03			286,901
1921	43,966	5 51			242,417
1922	37,489	5 98			244,396
1923	45,449	4 91			223,102
1924	8,091	5 75			46,513
1925					
1926	10,829	11 73		19 39	126,999
1927	52,648	9 00		6 84	473,673
1928	57,883	7 16	86·6	6 64	414,596
1929	53,595	6 60	90·21	8 03	353,625
1930	52,106	10 24		8 83	534,397
1931	52,628	11 14			586,251
1932	56,492	9 28		8 31	524,329 69[1]
1933	48,705				521,410 06[2]
1934	64,952				702,720 20[2]

* Figures up to 1927 from Ont. Dept. of Mines Repts.; subsequent to 1927 from Ann. Repts. of Kirkland Lake Gold Mining Co., Ltd.

[1] Does not include premium.

[2] Includes gold premium.

LAKE SHORE MINE

Lake Shore Mines, Ltd. owns five claims lying immediately east of the Teck-Hughes mine, between the latter and the Wright-Hargreaves mine, including 2,800 feet in length of the main Kirkland Lake ore zone. The surface plant is on the south shore of the lake. The mine workings are largely beneath the lake. In 1932 or 1933 the company purchased further adjoining property to the south in order to protect itself against the possibility of the ore-bodies passing at depth beyond its southern boundary.

The property was staked originally by Harry Oakes, who still controls it, and Lake Shore Mines, Ltd. was incorporated in February, 1914. Development work was started in the same year, a shaft being sunk on the South vein, which outcrops on the shore of the lake; the outcrop of the North, or Main, vein lies entirely beneath the lake on the Lake Shore property. It was not till March, 1918, that the first mill—a 65-ton cyanide plant—was put into operation. Since 1918, both mining and milling operations have expanded steadily and rapidly, till to-day the mine is the largest gold producer on the American continent and one of the largest in the world.

Operations are carried on through two principal shafts, the No. 1 and the No. 3, which are connected by cross-cuts on various levels. On June 30, 1933, the No. 1 shaft had reached a depth of 4,503 feet and levels were established at 125-foot intervals down to the 4,450-foot level; and No. 3 shaft had been completed to a depth of 3,950 feet. On June 30, 1934, the 4,450-level was still the lowest in the mine. Preparation had been made, however, to continue sinking to greater depths, but "the very considerable tonnage of lower grade material made available for mining, to a large extent by the increases in the world price for gold, had removed for the immediate future the necessity of intensive exploration in lower horizons of the mine." During the fiscal year ending June 30, 1934, all the ore stoped came from above the 2,700-foot level; and all mining is now done by cut-and-fill methods except in narrow portions of No. 1 vein, when the ore is broken on to stulls. Ore widths vary from eight to over fifty feet.

The mill now has a rated capacity for the treatment of 2,300 tons of ore a day. Mill efficiency was increased in 1932 by the introduction of oil flotation in the mill circuit.

TABLE XXXIX

Production Record of Lake Shore Mine[1]

Accounting period	Tons milled	Recovery per ton	Operating costs[3] per ton milled	Total value[4] recovered	Estimated value of broken ore reserves only, at end of accounting period	
		$	$	$	$	tons
March 1918 to Nov. 30, 1918.....	14,948	24 76	....	369,680	....	....
Dec. 1, 1918 " 1919.....	11,907	24 67	....	294,514	185,941	6,035
" 1919 " 1920.....	18,889	25 61	....	483,702	520,575	18,702
" 1920 " 1921.....	21,618	21 22	....	460,186	700,730	28,298
" 1921 to June 30, 1923.....	36,825	22 57	....	833,665	801,568	34,700
July 1, 1923 " 1924.....	24,223	23 97	....	578,243	1,127,128	45,069
" 1924 " 1925.....	96,838	18 72	....	1,812,495	2,148,260	85,365
" 1925 " 1926.....	125,676	17 79	....	2,235,184	4,346,799	181,534
" 1926 " 1927.....	214,335	14 46	....	3,105,048	5,079,130	262,053
" 1927 " 1928.....	237,962	15 25	....	3,629,318	....	....
" 1928 " 1929.....	367,015	14 90	6 34	5,504,859	6,524,797	....
" 1929 " 1930.....	467,648	14 06	5 85	6,576,780	6,105,400	....
" 1930 " 1931.....	698,624	13 10	5 16	9,152,935	6,850,000	....
" 1931 " 1932.....	834,434	14 81	5 24	12,356,759	4,490,000	258,914
" 1932 " 1933.....	797,673	14 30	5 63	11,306,308	3,847,550	219,859
" 1933 " 1934.....	836.991	19 57	5 07	10,026,451	[5]	230,858
Total..............	4,805,669	....	....	68,726,126	....	....

---

[1] Compiled from Annual Reports of Lake Shore Mines, Ltd.

[3] Exclusive of depreciation and taxes.

[4] Gold at $20.67 an ounce.

[5] Value 0·81 ounce a ton.

MACASSA MINE

The Macassa mine, the property of Macassa Mines, Ltd., consists of six claims covering some 242 acres lying immediately west of Kirkland Lake Gold mine. It is the most westerly producer along the Kirkland Lake ore zone, or " main break ", of which it is estimated to contain a length of about 4,000 feet.

The two claims that originally constituted the property were formerly owned by Elliott-Kirkland Gold Mines, Ltd., who before they discontinued operations in 1917, had sunk a shaft to a depth of 525 feet on the "main break " and had done lateral work on the 300-, 400- and 500-foot levels. This work disclosed only one small pocket of rather low-grade ore which was found 50 feet west of the shaft on the 400-foot level.

The property was idle from 1918 till, in 1926, Macassa Mines, Ltd. was incorporated to take over and amalgamate Elliott-Kirkland Gold Mines, Ltd. and Macassa Gold Mines, Ltd., owners of adjoining properties.

Considerable work was done by the new company in 1926 and 1927, principally in the driving of a long drift to the west on the 500-foot level; but early in 1927 operations were again suspended, until further financing could be arranged. A little further underground work was done in 1928 and in addition some diamond-drilling.

In April, 1931, satisfactory financing having been arranged, the sinking of a new vertical shaft was started near the centre of the property; and at the same time a contract was made with the Kirkland Lake Gold Mining Company to extend their 2,475-foot level into the Macassa property with a view to connecting it ultimately with the bottom of the new shaft and thus explore Macassa ground.

In August, 1932, the new shaft had reached the projected depth of 2,500 feet and had been connected up with the drift from the Kirkland Lake Gold mine. The latter on its way through Macassa ground had passed through ore sections of good width and grade for an aggregate length of 1,076 feet. Further development of the ore-bodies so disclosed having demonstrated that they were of considerable extent the building of a cyanide mill capable of treating 200 tons of ore a day was forthwith decided upon. Excavation for the foundation of the mill started on June 9, 1933, and the mill went into operation on October 16, treating about 100 tons of ore a day.

On March 31, 1934, the mill was operating at capacity, namely 200 tons a day; and total production up to that date was bullion having a gross value of $402,798 from 24,624 tons of ore milled. During the company's fiscal year ending March 31, 1935, bullion having a gross value of $1,058,958.29 was recovered from 66,534 tons of ore milled and dividends to the amount of $262,806.80 were paid to shareholders.

During the fiscal year also the central shaft was deepened to 3,000 feet to permit of the opening of four new levels.

Positive ore reserves on March 31, 1935, were 56,900 tons of unbroken ore averaging 0·44 ounce of gold a ton; 11,600 tons of broken ore averaging 0·49 ounce of gold a ton; and 3,400 tons averaging 0·43 ounce of gold a ton, in an ore dump on the surface.

MOFFATT-HALL MINE

Moffatt-Hall Mines, Ltd. is the owner of 15 claims, south of and adjoining the Bidgood property in Lebel township; and like the latter is reached by road from Kirkland Lake, about 7 miles distant. The Nipissing Central railway passes close to the property.

Moffatt-Hall Gold Mines, Ltd., the former owner of this group of claims, was incorporated in February, 1920. In 1923, the Tonapah Mining Company had the property under option, but after considerable surface prospecting the option was dropped. In August, 1928, Moffatt-Hall Mines, Ltd. was incorporated to acquire the assets of Moffat-Hall Gold Mines, Ltd., and about the same time the property was again put under option, this time to McIntyre Porcupine Mines, Ltd., who after systematic surface prospecting and diamond-drilling two of the veins found, also dropped their option—in June, 1929. No further work was done on the property till 1931, when, in April, a contract was let by the company for the sinking of a 2-compartment shaft at a point about 800 feet south of Bidgood-Kirkland's No. 2 shaft. By March 26, 1932, when the mine was closed down, the shaft had reached a depth of 550 feet and lateral work had been done on four levels—at depths of 150, 300, 425, and 550 feet respectively. This work disclosed some short lengths of ore. Early in 1934 the mine was leased to Hugh Jardine who shipped 2,238 tons of ore averaging 0·737 ounce of gold a ton to Noranda smelter. Later in the year Jardine's lease on the Moffatt-Hall was taken over by Bidgood-Kirkland Gold Mines, Ltd., and Moffatt-Hall ore is now being treated by the Bidgood Company in the Bidgood mill. Total gold production from the Moffat-Hall mine in 1934 was 2,525 fine ounces from 8,476 tons of ore treated.

SYLVANITE MINE

The property of Sylvanite Gold Mines, Ltd. covers some 208 acres lying immediately east and north of the Wright-Hargreaves mine. It includes some 1,500 feet in length of the main Kirkland Lake ore zone.

The mining claims now constituting the Sylvanite property were originally known as the Wright and the Robbins claims and were among the first to be staked in the Kirkland Lake camp. Visible gold, in narrow quartz veins, was found on them, but, on the whole, surface evidence of large ore-bodies was not particularly strong. Sylvanite Gold Mines, Ltd. was formed to develop the property in 1913; but for a number of years work was carried on in a more or less desultory way and it was not until 1922 that, stimulated by spectacular developments on neighbouring properties, an extensive program of underground exploration was seriously undertaken. A series of faults made underground operations rather difficult, but results were sufficiently successful to warrant the erection of a 250-ton cyanide mill in 1927. Milling capacity has since been increased to 350 tons a day.

The mine is served by two shafts, the No. 2 and the No. 4. The No. 2, or main shaft, had been sunk to a depth of 3,642 feet and levels had been established to 3,600 feet on March 31, 1934.

TABLE XL

Production Record of Sylvanite Mine[1]

Accounting period	Tons milled	Value re-covered per ton	Costs[2] per ton milled	Total[4] value re-covered	Ore reserves at end of accounting[3] period		
					Tons	Average value per ton	Gross value
		$	$	$		$	$
Eight months ending March 31, 1928..	57,341	10 62	5·787	609,182	30,437	....	....
Year ending March 31, 1929..........	70,833	10 41	8·096	737,573	49,634	....	....
" " 1930..........	75,408	9 16	8·135	690,400	62,335	....	....
" " 1931..........	83,034	10 08	7·73	837,014	74,250	....	....
" " 1932..........	94,276	10 07	6·97	948,926	88,072	....	....
" " 1933..........	96,140	oz. 0·40	6·81	912,377	95,529	....	....
" " 1934..........	98,311	0·52	6·58	1,558,913	82,735	....	....

[1] Compiled from Ann. Repts. of Sylvanite Gold Mines, Ltd.
[2] Does not include depreciation and taxes.
[3] Broken ore only; values not stated.
[4] Gold in Canadian funds.

TECK-HUGHES MINE

The Teck-Hughes mine of Teck-Hughes Gold Mines, Ltd., is a 764-acre property lying immediately east of the Kirkland Lake Gold mine, between the latter and the Lake Shore mine. Production so far has been from mining claims L 1238 and T 16626, the latter of which was formerly known as the Orr mine. The length of Kirkland Lake main ore zone on Teck-Hughes ground is about 1,500 feet.

The first development work was done on L 1238, in 1912; and in the following year Teck-Hughes Gold Mines, Ltd. was incorporated. For several years exploration of the property met with little success. Several shallow shafts were sunk, some lateral work underground was done, and some small ore-shoots were found; but nothing indicated the great future value of the property. In July, 1914, the Nipissing Mining Company took an option on it, but nearly a year of exploratory work yielded such discouraging results that all work was stopped in March, 1915, and the option was dropped. In August, 1915, parties connected with Buffalo Mines, Ltd. obtained control of the Teck-Hughes Company. A 50-ton cyanide mill was built and put in operation in 1916, the first production returns being made in 1917. In 1918, both mine and mill were shut down for a short time, owing to a scarcity of labour and the high cost of supplies; and again, in 1919, on account of a miners' strike. On October 1, 1920, bonds that had been issued to provide funds for the development of the mine were in default—both principal and interest—operations up to this time having proved unprofitable. A reorganization of the company was effected and money for the further carrying on of development work was raised by means of a new bond issue and the issue of new stock. By 1921, some rich ore-shoots were developed in the lower levels of the mine; the outlook had become much brighter; and milling capacity was increased to about 160 tons of ore a day. In 1923, a new company, Teck-Hughes Gold Mines, Ltd., was incorporated to acquire the assets of the old Teck-Hughes Company and also of Orr Gold Mines, Ltd., into whose property lying immediately south of Teck-Hughes the ore-shoots on the latter passed.

At present operations are carried on through three large shafts, of which one, the South shaft, has been sunk with a view to extending it to great depth. It is planned to carry on deep mining in two hoisting stages—the first from the surface to the 30th level at a depth of 3,605 feet; the second, from the 30th to the 55th level, or a total depth of 6,730 feet. A three-compartment inclined winze (No. 2), started in the foot-wall of the ore zone at the 29th level is being sunk to open up new levels at 125-foot intervals below the 30th level. A second inclined winze (No. 3) was started at the 40th level and is being sunk behind the foot-wall of the ore zone.

According to the company's annual report for the fiscal year ending August 31, 1933, the South Shaft Extension had been sunk to a depth of 5,515·6 feet; the No. 2 winze completed to the 40th level; and No. 3 winze had reached a vertical depth of 5,074.

At the end of the fiscal year ending August 31, 1934, the deepest working was No. 3 winze, at a vertical depth of 5,735 feet, and the president of the company states: "the new levels that were opened up during the year below the 40th show a diminution both in average grade and total tonnage per level although results on the 45th level seem to indicate a return to better ore conditions. It now seems probable that the limit of depth for profitable mining will be reached sometime within the next three years. New ore in addition to that from deep levels is being developed in the older portions of the mine where mining had ceased to be profitable under former conditions."

In an interim report for the six months' period ending February 28, 1935, it is stated: that the 49th level station (at a depth of 5,980 feet) on the No. 3 winze was completed, and No. 3 winze, now being sunk to the 50th level, had reached a depth of 6,000 feet below the collar of the Central shaft. Total *positive* ore reserves between surface and the 50th level are estimated at 693,624 tons averaging 8·25 dwt. of gold a ton, or a total gold content of 5,722,553 dwt.

The milling rate was reduced from, approximately, 1,300 tons to approximately 1,050 tons a day in September, 1934.

TABLE XLI

Production Record of Teck-Hughes Mine[1]

Accounting period	Tons milled	Re-covery per ton	Costs[2] per ton milled	Total[4] value recovered	Estimated ore reserves at end of accounting period[3]		
					Tons	Average value per ton	Gross value
		$	$	$		$	$
Year ending Aug. 31, 1917	6,291	7 70	....	31,777	....	....	....
" " 1918	15,879	7 87	....	104,354	....	....	....
" " 1919	16,907	8 86	9 24	149,875	26,600 60,000	10 00 9 70	....
" " 1920	No Annual Report published						
" " 1921	32,634	9 34	8 95	304,792	98,890	9 17	907,140
" " 1922	43,300	11 11	9 00	481,144	79,974	....	1,183,176
" " 1923	34,690	28 30	12 63	981,525	131,193	....	2,533,686
" " 1924	42,381	26 23	12 60	1,111,674	....	....	....
" " 1925	48,718	18 98	11 77	924,581	....	....	....
" " 1926	79,564	18 37	9 54	1,461,367	....	....	....
" " 1927	114,765	18 35	9 60	2,105,545	....	....	....
" " 1928	276,652	16 28	6 32	4,504,707	....	....	....
" " 1929	331,150	14 76	6 58	4,889,127	....	....	....
" " 1930	340,675	15 90	6 41	5,415,970	576,289	17 43	10,044,009
" " 1931	396,200	15 08	6 06	5,973,120	645,384	14 28	9,216,093
" " 1932	475,700	12 52	5 60	5,953,687	626,489	12 66	7,931,338
				oz.		dwt.	oz.
" " 1933	474,500	....	5 57	241,042	679,981	11 04	375,495
" " 1934	474,700	....	5 75	181,453	763,363	8 46	323,088

[1] Compiled from Annual Reports of Teck-Hughes Gold Mines, Ltd.
[2] Including depreciation but not taxes.
[3] Positive ore only. No estimates of ore reserves published between 1923 and 1930.
[4] Does not include premium on gold.

TOBURN (TOUGH-OAKES-BURNSIDE) MINE

The Tough-Oakes-Burnside claims, now the property of Toburn Gold Mines, Ltd., covers 343 acres in one block immediately east of the Sylvanite mine. It is the last mine, going eastward, on which commercial ore-bodies have as yet been developed in the main ore zone of the Kirkland Lake camp. It was the first, and for several years the only important producer at Kirkland Lake.

The original Tough-Oakes claims were staked by Harry Oakes, now president of Lake Shore Mines, and the Tough brothers. In January, 1912, shortly after Wright's discovery on the Wright-Hargreaves property, spectacular surface discoveries were made also on the Tough-Oakes—the richest surface showings yet found in the Kirkland Lake camp. For the three following years rich ore, mostly from open-cuts and development shafts and drifts, was hand-sorted on a bumping table; the high-grade sorted material being bagged and shipped to smelters while the residue passed on to a 5-stamp battery equipped with amalgamation plates, which caught about half of the remaining gold. The tailing from the plates was impounded for further treatment. Up to the end of 1914, high-grade hand-sorted ore to the amount of 313·8 tons, having a gross value of $827,811, was shipped; while, during the same period, 5,468 tons of ore treated in the mill yielded gold and silver to the value of $69,403. The impounded tailing was later re-treated in a 100-ton cyanide mill that went into operation in March, 1915.

In spite of the splendid showings of rich ore found on the surface and in the upper levels of the mine, no large continuous ore-bodies were developed, and consequently all work ceased on July 13, 1918. The mine was re-opened in 1919, but after three months' operation was again closed on account of a miners' strike. The next resumption of operations was on April 15, 1921. Control of the property had at this time passed into the hands of Kirkland Lake Proprietary, Ltd., of London, England. In September, 1923, Tough-Oakes-Burnside Gold Mines, Ltd. was incorporated in Canada to take over the Tough-Oakes and Burnside claims from Kirkland Lake Proprietary, the latter retaining a four-fifths stock interest in the Canadian company. With money raised by the sale of the remaining one-fifth of the new company's stock, supplemented by such operating profit as could be derived from the mill—the capacity of which had been increased in 1926 to about 220 tons of ore a day—an extensive campaign was undertaken to try and discover new ore-bodies. In December, 1927, further funds for exploratory work were raised by an issue of bonds. Efforts to find new large ore-bodies continued, however, to be unsuccessful and in November, 1928, the mine was closed down by the action of the bondholders. At this time there was a main hoisting shaft from surface to the 1,090-foot level and an interior shaft from the 1,090- to the 1,850-foot level. In 1930, Bunker Hill Extension Mines, Ltd. obtained an option on the property from the bondholders, and in January, 1931, in association with the Premier Gold Mining Company, Ltd., of British Columbia, incorporated Toburn Gold Mines, Ltd. to take over the option and carry on further exploratory work. Some small ore-bodies having been found, the old 100-ton cyanide mill was reconditioned and put in operation in August, 1932, and has been in operation ever since.

Estimated ore reserves on December 31, 1933, were 50,200 tons averaging 0·66 ounce of gold a ton; and on December 31, 1934, 60,550 tons averaging 0·63 ounce a ton.

A first dividend was declared on January 23, 1934.

TABLE XLII

Production Record of Tough-Oakes-Burnside Mine[1]

Year	Ore milled, tons	Bullion produced	Recovery per ton	Year	Ore milled, tons	Bullion produced	Recovery per ton
		$	$			$	$
1913......	2,220	66,632	30 01	1923.....	1,803	12,174	6 75
1914......	3,734	117,644	31 24	1924.....	8,438	47,548	5 53
1915......	26,196	555,539	21 21	1925.....	34,152	263,064	7 70
1916......	39,865	711,625	17 85	1926.....	43,871	309,709	7 06
1917......	38,695	342,831	8 86	1927.....	38,999	153,215	3 93
1918......	22,000	139,683	6 35	1928.....	14,396	82,316	5 72
1922......	16,108	107,481	6 05	Total..	290,477	2,909,461	

[1] Operated up to 1918 by Tough-Oakes Gold Mines, Ltd.; in 1922 and up to Aug. 31, 1923, by Kirkland Lake Proprietary; after that by Tough-Oakes Burnside Gold Mines, Ltd., till Nov. 1928; now by Toburn Gold Mines, Ltd.

TABLE XLIII

Production Record of Toburn Mine

Year	Tons milled	Gold per ton milled, fine ounces	Gold produced, fine ounces	Mill recovery, per cent
1932..	14,689	0·723	9,840	92·7
1933..	36,913	0·659	23,020	94·7
1934..	36,230	0·583	20,401	96·6

WRIGHT-HARGREAVES MINE

The Wright-Hargreaves mine of Wright-Hargreaves Mines, Ltd. includes three mining claims aggregating 152 acres lying immediately east of the Lake Shore mine. The main Kirkland Lake ore zone crosses the property over a length of about 4,000 feet.

It was on part of what is now known as the Wright-Hargreaves mine that the first important discovery of gold was made in the vicinity of Kirkland Lake, in 1911, by W. H. Wright. This consisted of short, rich ore-shoots showing free gold in narrow quartz veinlets. In 1913, parties who had the claims under option discovered a 5-foot vein (now known as the North vein) about 550 feet north of the original discovery; and took from it and shipped to a smelter about three-quarters of a ton of ore that yielded gold at the rate of $331.35 a ton. In spite of this, the option was allowed to lapse; the claims reverted to the original owners and lay idle for several years. In June, 1916, Wright-Hargreaves Mines, Ltd. was incorporated to take over the property, and active development commenced. From July, 1918, till the spring of 1920 the mine was shut down partly to facilitate the building of a new head-frame and a mill, and partly on account of the miners' strike of 1919. The mill—a cyanide mill of 175-tons daily capacity—was finished and put in operation on May 1, 1921. Since then operations have been continuous. Milling capacity had been increased to 700 tons a day in 1927, but was curtailed to about 550 tons a day in 1929, owing to lack of developed ore reserves. Since 1929, developments underground have been so favourable that milling capacity, at first increased to 800 tons a day, was stepped up to about 1,000 tons a day in 1934.

The mine is worked through two shafts, the No. 4, or Central shaft, which was completed to a depth of 4,000 feet in 1933, and the No. 3 to a depth of 4,089. In September, 1934, it was planned to sink a new, interior shaft to develop the mine below the present bottom.

TABLE XLIV

Production Record of Wright-Hargreaves Mine[1]

Accounting period	Tons milled	Average value per ton	Recovery per ton	Costs[2] per ton milled	Total value[3] recovered	Ore reserves at end of accounting period[3]		
						Tons	Average value per ton	Gross value
		$	$	$	$		$	$
Eight months ending Dec. 31, 1921....................	36,081	13 96	13 00	....	468,665	....	....	....
Year ending Dec. 31, 1922....	66,181	12 49	11 52	6 32	762,752	....	....	....
" " 1923....	79,242	10 48	9 52	5 93	754,978	....	....	....
" " 1924....	84,487	14 16	12 89	6 33	1,088,725	....	....	....
" " 1925....	147,939	14 49	12 93	5 00	1,913,401	....	....	....
" " 1926....	153,392	15 66	14 02	5 34	2,150,844	....	....	....
" " 1927....	209,164	11 77	10 51	5 47	2,151,916	....	....	....
" " 1928....	256,331	8 36	7 20	5 33	1,845,923	....	....	....
" " 1929....	188,238	10 29	9 25	7 04	1,741,872	418,877	11 30	4,727,551
" " 1930....	220,430	12 20	11 03	5 96	2,431,896	619,605	11 83	7,334,604
" " 1931....	266,352	11 73	10 93	6 36	2,912,309	753,510	11 65	8,776,551
" " 1932....	295,525	12 85	12 00	6 30	3,546,903	951,939	13 54	12,888,042
Eight months ending Aug. 31, 1933....................	193,441	13 56	12 63	7 14	2,443,760	998,061	13 75	13,726,809
Year ending Aug. 31, 1934....	330,741	13 68	13 07	7 28	4,321,945	1,185,204	0·64 oz.	15,643,197
	2,527,544	12 34	11 29	....	28,535,888	....	....	....

[1] Compiled from Annual Reports of Wright-Hargreaves Mines, Ltd.
[2] Includes depreciation and taxes.
[3] Gold at $20.67 an ounce.

MATACHEWAN AREA

ASHLEY MINE

The Ashley mine, of the Ashley Gold Mining Corporation, Ltd., a subsidiary of the Mining Corporation of Canada, comprises 950 acres of mineral lands situated in Bannockburn and Argyle townships in the Matachewan gold-bearing area. The camp is reached by road from Elk Lake, the terminus of a branch line of the Temiskaming and Northern Ontario railway.

Gold was first discovered in the Matachewan area in 1916; and between 1922 and 1926 there was considerable activity in prospecting and developing a number of the showings. Following 1926, interest in the area waned until in October, 1930, promising new discoveries made on the Ashley claims in Bannockburn township, by prospectors in the employ of the Mining Corporation of Canada, again attracted widespread attention to the district. Diamond-drilling of the new find was at once undertaken by the Mining Corporation, the principal owners, with such encouraging results that before the spring break-up in 1931 complete equipment for shaft-sinking and underground development had been sent into the property and erected.

The mine has been developed to a depth of 750 feet on six levels at 125-foot intervals and a mill having a rated capacity for the treatment of 150 tons of ore a day is being operated.

Ore reserves at December 31, 1934, were 31,000 tons carrying slightly over 0·3 ounce of gold a ton; as against 37,975 tons averaging 0·456 ounce at the end of 1933.

According to the annual report of the Mining Corporation of Canada for 1934: "Conditions at this property do not lend themselves to low costs and include exceedingly hard rock with high mining and grinding costs, excessive water with high pumping costs, as well as narrow vein and fault conditions which increase development charges."

From the time milling began in August, 1932, to December 31, 1933, 44,780 tons of ore carrying 0·501 ounce of gold a ton, or a total of 22,431 ounces, were treated yielding bullion worth $568,110 in Canadian funds. During 1934, 43,532 tons of ore averaging 0·315 ounce of gold were milled yielding bullion worth $456,832 in Canadian funds.

MATACHEWAN CONSOLIDATED MINES

The property of Matachewan Consolidated Mines, Ltd. consists of some 22 claims covering about 880 acres in Powell and Cairo townships. It includes the old Otisse claim on which gold was found by Samuel Otisse in 1917, shortly after the discovery on the Young-Davidson property, which adjoins it on the west.

Extensive prospecting was done on the Otisse in 1918, when it was under option to the Colorado and Ontario Mining Company; and later by Matachewan Gold Mines, Ltd. Two shafts were sunk, one to a depth of 170 feet, the other to 30 feet. As underground operations were found to be costly under conditions then prevailing in the district little further was done until 1933, when Matachewan Consolidated Mines, Ltd., controlled jointly by Ventures Ltd., and the former owners—Matachewan Canadian Gold, Ltd.—took over the property and commenced operations in April. Active development work was carried on at the 160-foot level, the only portion of the mine yet opened up, to the end of July, 1934, when substantial quantities of ore carrying 0·20 ounce of gold to the ton having been developed, the building of a 100-ton cyanide mill and the sinking of a new central shaft was decided upon. The mill was completed and ready for production on October 31, and during November and December, 1934, treated 4,680 tons of ore which yielded 679·38 fine ounces of gold and 99·5 ounces of silver. Power is supplied by the Ontario Hydro-Electric Power Commission.

YOUNG-DAVIDSON MINE

The Young-Davidson mine is situated in the Matachewan gold area, so named from a Hudson Bay Co.'s post on the Montreal river, about 26 miles northeasterly from Elk Lake, the terminus of a branch line of the Temiskaming and Northern Ontario railway, with which it is connected by good road. The property consists of five claims, covering approximately 163 acres in Powell township.

Though the presence of gold in the neighbourhood of Matachewan was known for several years previously, active attention was first directed to the area in 1916 when gold was found on the Davidson claims. Considerable surface and a little underground work was done in the following years but extensive underground development was not attempted until the Porcupine Goldfields Development and Finance Company, of London, England, secured an option on the Young-Davidson group and adjoining claims in 1923. After considerable diamond-drilling, underground operations were commenced on the Young-Davidson in June, 1924. A shaft was sunk to a depth of 200 feet and some 2,000 feet of lateral work was done on the 100-foot and 200-foot levels. Assay values, however, were found to be erratic and the ore on the whole low grade. These factors together with the somewhat remote situation of the deposits from rail transportation and the lack of a local supply of cheap power, made the property unattractive at that time, so the option was dropped in 1925. The property then lay idle until 1933.

Late in 1932, the attention of Hollinger Gold Mines, Ltd. having been drawn to the property as a possible large low-grade mine, that company decided on a detailed investigation of its potentialities. A thorough sampling showed the presence of upwards of 2,500,000 tons of ore averaging $2.30 a ton in gold (gold at $20.67 an ounce) underlying a surface area of about 2¾ acres. As this could be cheaply mined, to a large extent by open-cast methods, and as milling tests had indicated a profit of about 70 cents a ton if operations were carried out on a large scale, the Hollinger company entered into an agreement with the owners, Young-Davidson Mines, Ltd., to operate the mine on the basis of a proportion of the profits. A mill was accordingly built on the property and was put in operation on September 8, 1934, and at the end of the year was treating 625 tons of ore a day. The total amount of ore treated to the end of the year was 51,842 tons having an average gold content of $1.76 with gold at $20.67, or $2.88 at the current price. The mine was worked as an open pit throughout the winter of 1934-35, but under many difficulties, and the experience indicates that underground mining in winter will be more satisfactory in future. Plans are under way for this development.

Operations to the end of 1934 were conducted at a profit.

Power is obtained from the Ontario Hydro-Electric Power Commission's main Sudbury transmission line, through a short branch line.

NORTHWESTERN ONTARIO

ARDEEN (MOSS) MINE

The Moss, originally known as the Huronian mine, later owned by Moss Gold Mines, Ltd., is a 900-acre property situated in the township of Moss, about 90 miles west of Port Arthur, in the Thunder Bay district. It is connected by a road 18½ miles long with Tip Top siding on the Fort Frances branch of the Canadian National railway.

The first recorded discovery of gold in northwestern Ontario was made at the Moss mine, in 1871. Between 1882 and 1885 an attempt was made to work the property by a company known as the Huronian Mining Company. Two shafts were sunk, one 50 feet, the other 143 feet deep; and a 10-stamp amalgamation and concentration mill was built. Between 800 and 900 tons of ore is said to have been put through the mill, but little gold was caught on the plates, most of it going into the concentrate. It was then proposed to build a chlorination plant to treat the latter, but owing to the, at that time, inaccessible situation of the mine and the consequent high operating cost, as well as to the fact that the company had run out of funds, it was decided instead, in 1885, to close down the mine and await more favourable conditions.

The mine remained idle for 40 years, till 1926, when it was acquired by the Shield Development Company, by whom, after some further development work had been done, it was transferred to Moss Gold Mines, Ltd. A cyanide mill designed to treat 150 tons of ore a day was built and went into operation in April, 1932. In September, 1933, the company having got into financial difficulties was put into the hands of a receiver. In the subsequent re-financing Ardeen Gold Mines, Ltd. was formed to take over the property in January, 1934, the shareholders of Moss Gold Mines receiving one share of Ardeen for each three shares of Moss held.

The main shaft was sunk to a depth of 1,030 feet in 1934 and two new levels opened—one at 875 and one at 1,000 feet.

In 1932, 25,363 tons of ore was milled yielding bullion to the value of $173,903; in 1933, 34,789 tons, yielding $201,304; and in 1934, 38,143 tons, yielding $135,387.[1]

ALGOMA SUMMIT (McCARTHY-WEBB) MINE

The property of Algoma Summit Gold Mines, Ltd. consists of seven mining claims comprising some 322 acres, situated in township 49, range XXVII, about 5 miles east of Goudreau station on the Algoma Central railway, 170 miles north of Sault Ste. Marie It was formerly known as the McCarthy-Webb property.

Gold, in quartz veinlets in narrow shear zones, was found on the McCarthy-Webb (or Webb-McCarthy) claims in 1917 or 1918. In December, 1920, an option was taken on them by the O'Brien interests of Cobalt, but was subsequently dropped. In November, 1925, McCarthy-Webb Goudreau Mines, Ltd. was incorporated and took over the property. In 1926 according to the 35th Annual Report of the Ontario Department of Mines "The work accomplished to date consists of surface stripping, sinking of two test shafts to depths of 28 and 35 feet respectively, 1,100 feet of diamond drilling, and the erection of camps and a blacksmith shop."

In 1929, the Consolidated Mining and Smelting Company of Canada took an option on the property and were prepared to go ahead with a program of exploration and development when litigation developed between the original owners, Messrs. McCarthy and Webb, and the McCarthy-

---

[1] Gold at $20.67 an ounce.

Webb Goudreau Mines Company. The option was dropped the same year. In 1930, it was optioned to Consolidated Smelters for a second time and in 1930 and 1931 the company gave it an extensive and thorough sampling, but failed to find sufficient ore to warrant further expenditure, and the option was again dropped.

In 1933, a 25-ton mill to treat ore by amalgamation and concentration was built, though little or no development work, beyond that described in 1926, appears to have been done up to this time. Early in 1934, the properties of McCarthy-Webb Goudreau Mines, Ltd. were sold to a new company, Algoma Summit Gold Mines, Ltd.; and in July the mill was put in operation, producing 144 ounces of gold from 421 tons of ore milled before the end of the year. According to recent press reports, plans have been completed for the sinking of a 3-compartment shaft to a depth of 500 feet, and for the increasing of mill capacity to 75 tons a day.

CASEY SUMMIT MINE

The Casey Summit property, formerly owned by Casey Summit Gold Mines, Ltd., but now reported to have been acquired by a new company called Argosy Gold Mines, Ltd., includes some 800 acres situated at Summit lake in the Patricia portion of Kenora district. It is about 100 miles due north of Sioux Lookout on the Canadian National railway and can best be reached by aeroplane from that town. There is also a water route about 200 miles in length with many portages to the property—via Lac Seul, Woman lake, and Birch lake.

The first work was done on this property in 1931, by the Casey Mountain Operating Syndicate, Ltd., later known as Casey Summit Gold Mines, Ltd. After about 2,000 feet of preliminary diamond-drilling—with encouraging results—a shaft was sunk to a depth of 85 feet and 140 feet of lateral work was done at this elevation. Operations were suspended in the fall of 1931, however, and were not resumed until the late summer of 1933. During 1934, the shaft reached a depth of 300 feet and lateral work had been done on three levels. In October, a 50-ton mill for the recovery of gold by amalgamation was put in operation; but before the end of the year all work was stopped, the company having got into financial difficulties.

In the late spring of 1935 it was announced that all the assets of Casey Summit Gold Mines, Ltd., were to be acquired by a new company, called Argosy Gold Mines, Ltd., controlled jointly by Kenty Gold Mines, Ltd., Northern Canada Mining Corporation, and Coniagas Mines, Ltd. It was announced at the same time that mine development would be resumed immediately, but that there would be no resumption of milling operations until considerably more ore was put in sight. Ore reserves at this time were estimated at, approximately, 18,000 tons of an average grade of $23 a ton (with gold at the current price) in an ore-shoot 430 feet long and 2·8 feet wide. During the time the mill was in operation, in 1934, 888 fine ounces of gold was recovered from 4,094 tons of ore treated.

CENTRAL PATRICIA MINE

Central Patricia Gold Mines, Ltd. owns a block of some 90 claims covering 3,837 acres, situated in the Pickle-Crow area of northwestern Ontario, a few miles north of the east end of lake St. Joseph, in Patricia portion of the district of Kenora. By aeroplane the property is about 95 miles from Alanwater, or 125 miles from Sioux Lookout, both aeroplane bases on the Canadian National railway. Supplies are taken in in winter over a snow road 110 miles long starting at Savant Lake station. Recently it was announced that a summer water route for the transportation of supplies would be available in 1935, from Hudson station on the Canadian National railway to the east end of lake St. Joseph.

The claims forming the nucleus of the company's present holdings were staked in 1928 by Alex Mosher and associates of Haileybury; and were later acquired by F. M. Connell of Toronto, who organized a company known first as Crow River Mines, later as Central Patricia Mines, Ltd., to develop them. After considerable preliminary diamond-drilling, a shaft was sunk to a depth of 527 feet and four levels were opened up at 125-foot intervals, before the mine was closed down for lack of funds in September 1930. In 1931 the company was reorganized and the name changed to Central Patricia Gold Mines, Ltd.; and in February, 1932, operations were resumed. It was decided to put in a 50-ton mill to be in operation in the late summer of 1933, but owing to the loss of essential equipment through the ice, while it was being brought in in the spring, operations were again interrupted. Nevertheless, mill foundations and buildings were made ready; and most of the lost equipment having been salvaged from the bottom of the lake the mill was completed and in operation on May 27, 1934. In August, 1934, it was decided to double the mill capacity, i.e. bring it up to 100 tons a day.

On March 7, 1934, a contract was made with the Hydro-Electric Power Commission of Ontario for a supply of power to be furnished by the Commission from a plant to be built on the Albany river. Electric power from this source reached the mine in the spring of 1935, displacing the steam plant previously in use. Equipment for doubling the milling capacity also had been installed and was ready for operation in April, 1935.

From the commencement of milling operations at the end of May to December 31, 1934, bullion to the value of $219,563 was produced from 11,536 tons of ore milled.

Ore reserves at the end of 1934 were placed at 77,670 tons averaging 0·66 ounce of gold a ton.

DIKDIK MINE

This property of Dikdik Exploration Co., Ltd. includes mining claims Nos. 11070 to 11078, situated at Atigogama lake, about 12 miles northwest of Kinghorn station on the Canadian National railway, in the Thunder Bay district. Supplies are taken into the property over a winter road; in summer it can be reached by canoe and portage.

Gold was discovered on this group of claims by T. A. Johnston during the summer of 1933. Shortly afterwards they were taken over by the Dikdik Exploration Company of Montreal, who, in October, started cutting a winter road to them from Kinghorn. Actual mining was started in

December, in an open-cut on a narrow high-grade vein, from which during the following winter seven carloads of rich ore were shipped to the Hudson Bay Mining and Smelting Co.'s plant at Flin Flon, Manitoba. Early in 1934, a shaft was started and sunk to a depth of 150 feet, all in ore, but during the summer supplies ran out and, in consequence, work had to be suspended. During the winter of 1934-35 material for a 20-ton cyanide plant was taken in to the mine, and early in May, 1935, milling was reported to have started. The shaft, also, was reported to have reached a depth of 250 feet and a new level to have been started at that horizon.

The 230 tons of ore shipped from the open-cut during the winter of 1933-34 yielded 1,082 fine ounces of gold and 644 ounces of silver.

HOWEY MINE

The Howey mine of Howey Gold Mines, Ltd. is situated at the southeast angle of Red lake in Patricia portion, Kenora district. The property, which consists of some twenty-three claims, in the unsurveyed townships of Heyson and Dome, is about 75 miles due north of Favel station on the Canadian National railway, but is 175 miles from the railway by the power-boat and portage route by which supplies are brought into the camp from Hudson in the summer. In winter, supplies are brought in on snow roads that follow in part the summer water route, but are shorter. By aeroplane, the camp can be reached in about an hour and a half from Sioux Lookout, on the railway, both summer and winter.

The discovery of gold on the Howey claims was made in July, 1925, by the Howey brothers of Haileybury, who were prospecting for the Howey Red Lake Syndicate. Shortly after the discovery was made the property was optioned by Dome Mines, Ltd., but after some surface trenching and diamond-drilling had been done the option was dropped in 1926. J. E. Hammell then organized Howey Gold Mines, Ltd., and raised money for development purposes. Shaft-sinking started in 1927. Underground developments were so favourable that the building of a 500-ton cyanide mill was decided upon in 1928—the Hydro-Electric Power Commission of Ontario agreeing to develop a water-power at Ear falls, 41 miles away, to supply the mine and plant with electric power. This reached the camp early in 1930, and on April 2 the first unit of the new mill went into operation. Milling results were at first disappointing, but some additions to the mill equipment and the introduction of hand-sorting prior to crushing the ore now permit a very satisfactory profit to be made, and the payment of dividends started in 1934, when $500,000 was paid to shareholders. Milling capacity was increased to 1,350 tons a day in 1933. Operating costs are the lowest of any gold mine in the province.

In 1932 the mine workings were carried to a depth of 1,315 feet at which depth the lowest haulage level is situated. In 1934, the main shaft was sunk to the 1,500-foot level preparatory to exploring the deposit at that depth.

Estimated ore reserves as of December 31, 1934, were 2,155,087 tons, averaging approximately $3.50 a ton at the current price of gold.

TABLE XLV

Production Record of Howey Mine, 1930-1934

Year	Ore hoisted, tons	Value per ton of ore hoisted *a*	Ore milled, tons	Value per ton of ore milled *a*	Cost per ton of ore hoisted *c*	Recovery	Total value recovered *b*
		$		$	$	per cent	$
1930..........	111,230	....	110,438	....	4·23	....	460,428 36
1931..........	226,876	4 20	211,552	4 45	3·126	91·5	914,290 58
1932..........	329,249	3 70	284,664	4 21	2·471	92·4	1,268,780 07
1933..........	344,135	2 73	290,965	3 12	2·240	89·5	1,158,470 03
1934..........	481,757	2 20	396,109	2 64	1·830	90·3	1,594,222 51
Total.....	1,493,247	....	1,293,728	....	....	....	5,396,191 55

a Gold at $20.67 an ounce.
b Includes premium.
c Total operating expense before depreciation, Dominion and Provincial Taxes, and pre-operating charges.

JACKSON-MANION MINE

Jackson-Manion Consolidated Mines, Ltd., which is an amalgamation of Jackson-Manion Mines, Ltd. and Mint Ore Mines, Ltd., owns 56 claims covering approximately 2,600 acres in the vicinity of Woman and Confederation lakes in the Patricia portion of the Kenora district. The property, which is about 40 miles from the Howey mine on Red lake, can be reached from either Hudson or Sioux Lookout—both on the Canadian National railway—by boat or aeroplane.

The original Jackson-Manion property included 17 claims situated between Woman and Confederation (Clearwater) lakes in the southern part of the township of Dent. In the spring of 1926 gold was discovered on the south shore of Rowe lake, on these claims, which were shortly afterwards optioned to Noah Timmins, Inc. After some surface stripping and some diamond-drilling had been done the option was allowed to lapse in the summer of 1927.

A company known as Jackson-Manion Mines, Ltd. was then incorporated to develop the property and early in 1928 had started sinking a 3-compartment shaft. This at the end of March, 1929, had reached a depth of 404 feet and levels had been driven from it along the vein at depths of 125, 250, and 375 feet. Doubts having arisen as to the reliability of reports issued by the management as to the favourable nature of underground developments, independent engineers were sent to sample the workings in the winter of 1928-29, and these reported so unfavourably that all work was stopped early in the following August.

In February, 1933, a newly formed company—Jackson Mines Consolidated Mines, Ltd.—took over the old Jackson-Manion mine and the adjoining property of Mint Ore Mines, Ltd.—an undeveloped prospect. In October, 1933, the new company re-opened the Jackson-Manion mine, which had been idle since 1929, and some rich ore having been found, a 25-ton mill was built and went into operation in May, 1934, the first production being reported in June. Since then milling has been carried on fairly steadily but at a loss; and in March, 1935, it was reported that the company's consulting engineer had advised the shutting down of the mill until larger ore reserves had been developed in the mine. These at this time were said to be 26,000 tons, having an average value of $11.58 a ton with gold at $35 an ounce. Production from the commencement of milling in May to the end of 1934 was 1,019 ounces of gold and 621 ounces of silver from 3,443 tons of ore treated.

LEBEL ORO (LONG LAKE) MINE

Lebel Oro Mines, Ltd. is the owner of 9 claims, near the southwest end of Long lake, in timber berth 69, about 8 miles southwest of Sudbury. The property, which includes what was formerly known as the Long Lake mine, can be reached from Naughton station on the Canadian Pacific railway by a road 9 miles long.

The original claim of this group—W.D. 602—was bought by the Canadian Exploration Company, Ltd. in 1908 and underground development was carried on in 1909. In 1910 a small cyanide plant, to treat the ore, which is a fine-grained auriferous mixture of arsenopyrite, pyrite, pyrrhotite, galena, and chalcopyrite, by cyanidation, was completed and put in operation. Hydro-electric power from the Wahnapitae Power Company's plant on the Wanapitei river was brought into the mine in 1912; and additions made to the cyanide plant in 1913 brought milling capacity up to 120 tons of ore a day. The only known ore-body having been worked out, the plant was shut down in 1916. Some diamond-drilling in search of more ore and experimental work in an effort to recover the gold remaining in the mill tailing, done in 1916 and 1917, having been unsuccessful, all work ceased in the latter year. When underground work ceased in 1916 the shaft was 225 feet deep, with levels at depths of 80 and 180 feet; and a little work had been done on a third level, started from a winze sunk below the second level, at a depth of 325 feet. During this period of operation 142,265 ounces of gold was recovered from 150,000 tons of ore treated; and it was estimated that there remained on the dump approximately 140,000 tons of tailing carrying 0·09 ounce of gold a ton. The bulk of the ore milled came from an open pit extending from the surface to the 80-foot level.

After lying idle for some 16 years the property was acquired by Lebel Oro Mines, Ltd. in 1933. The mine was unwatered and sampled; and in July, 1934, the building of a 200-ton mill was begun to treat the material on the old tailing dump by flotation followed by cyanidation. The mill was finished in the fall of 1934 but had not been put in operation in April, 1935. Meantime a diamond-drilling campaign was being carried on in search of new ore-bodies.

LITTLE LONG LAC MINE

The property of Little Long Lac Gold Mines, Ltd. consists of a group of 35 claims on Little Long lake in the Thunder Bay district, Ontario. The chief development has been on claim T.B. 10560, two miles south of Geraldton station on the line of the Canadian National railway running from Port Arthur to Longlac. Transportation in winter is by road from Geraldton; in summer, by water from Hardrock siding—also on the Canadian National railway—seven miles east of the mine.

Visible gold was reported to occur in a quartz vein near the main narrows of Little Long lake some years prior to 1916. T. L. Tanton, who reported on the area in 1917, says: " On the Edie claim, near Main narrows, Little Long lake, gold occurs in angular fragments of quartz up to 3 inches in diameter in the drift along the shore. Quartz veins occur in place at this locality but no gold has been found in them."[1] A prospector named Tony Oklend is said to have found a boulder near the narrows, about this time, from which he obtained several thousand dollars' worth of gold. Search for the vein from which these rich fragments of quartz had come was however unsuccessful and was soon given up.

In the spring of 1932, following discovery of gold-bearing veins at Magnet lake, in the same area, Oklend and another prospector, Tom Johnson, went back to the vicinity of the narrows on Little Long lake, where Oklend had found the boulder many years before, and finding a rich gold-bearing quartz stringer on the south shore of the northwest arm of the lake staked, on July 2, 1932, the claims which form the nucleus of the Little Long Lac gold mine. The find was drilled by the Sudbury Diamond Drill Company and a continuous shoot of rich ore 600 feet long and 400 feet in depth was indicated on Claim No. T.B. 10560. As a result, Little Long Lac Gold Mines, Ltd. was organized to develop the mine in January, 1933. The sinking of a three-compartment vertical shaft was commenced on May 24, 1933, and by January 21, 1934, this had reached a depth of 465 feet, and four levels were being driven, at depths of 125, 204, 325, and 445 feet respectively. Sufficient ore having been developed to warrant it, construction of a 200-ton cyanide mill was decided upon, and this was finished and went into operation in November, 1934, treating daily between 160 and 170 tons of ore, averaging about three-quarters of an ounce of gold per ton.

McKENZIE-RED LAKE MINE

The property of McKenzie-Red Lake Gold Mines, Ltd., formerly known as the Martin-McNeeley claims, covers approximately 400 acres on the northern part of McKenzie island, about four miles north of the Howey mine, in Red lake.

Some surface work and trenching was done on the property in 1928 by the then owners, McNeeley Red Lake Holdings Ltd., and in 1931 further surface work was done by J. Monroe and associates, who sold their option to Coniagas Mines, Ltd. After doing some 3,500 feet of diamond-drilling over a length of 2,000 feet Coniagas dropped the option. In February, 1933, the present company was incorporated to develop and work the property, and in June the sinking of a shaft was started. This by the end of 1934 had been sunk to a depth of 250 feet with levels driven from it at depths of 150 and 250 feet; and from the 250-foot level an inclined winze had been sunk and two more levels opened at vertical depths of 350 and 450 feet.

The building of a 125-ton cyanide mill, which with some slight additions can be stepped up to 200 tons, was started in the fall of 1934, and completed in March, 1935. The first bullion was produced about the beginning of April.

---

[1] Geol. Surv., Canada, Summary Report 1917, Part E, p. 4E.

Ore reserves at the end of 1934 were estimated at 97,900 tons containing 42,782 ounces of gold, or an average of 0·437 ounce a ton.

Electric power for mine and mill is obtained from the Ontario Hydro-Electric Power Commission's hydro-electric plant at Ear falls through an extension 5½ miles long of the transmission line from Ear falls to the Howey mine.

McMILLAN MINE

The McMillan mine of McMillan Gold Mines, Ltd., consists of 34 claims on House lake, in Mongowin township, in the Sudbury district. The workings are on lot 11, concession III, about 1½ miles west of West River station on the Algoma Eastern railway (C.P.R.) and close to the automobile road from Little Current to Espanola.

The first work was done on this property in March, 1926, by McMillan Gold Mines, Ltd. After some preliminary diamond-drilling, shaft sinking was started in 1927, and development was continued till 1929, when the mine was closed owing to lack of funds with which to carry on. At the time of closing down, the shaft had reached a depth of 550 feet; and considerable lateral work had been done on two levels, at depths of 325 and 525 feet respectively. In June, 1929, P. E. Hopkins reported that four ore zones having a total length of 245 feet, an average width of 34·9 inches, and an average gold content of $7.33 a ton (gold at $20.67 an ounce), had been found on the 325-foot level and two zones having a total length of 213 feet, an average width of 43·9 inches, and an average gold content of $7.93 a ton, on the 525-foot level. The ore consists of arsenopyrite, pyrite, pyrrhotite, chalcopyrite, and native gold.

In 1931 and 1932 further diamond-drilling was done. In June, 1933, underground development was resumed and by October the shaft had been deepened to 650 feet. Before the end of the year a new level had been started at a depth of 625 feet.

In January, 1934, it was announced that a 125-ton cyanide mill would be built, and this was completed and in operation by August. Up to the end of the year 1,959 ounces of gold and 63 ounces of silver were recovered from 12,313 tons of ore treated.

Ore reserves as of December 31, 1934, are reported as: 31,900 tons carrying approximately between 0·15 and 0·25 ounce a ton; and 4,000 tons on a dump carrying 0·10 ounce a ton.

MINTO MINE

The Minto mine is one of several adjoining properties, including the Jubilee and the Cooper, owned by Cooper Gold Mines, Ltd., a subsidiary of Pioneer Mining Corporation. It is situated on Wawa lake in the Michipicoten district and can be reached from Sault Ste. Marie, via Hawk Junction, and the Algoma Central railway.

Some work was done on the Minto group of claims as early as 1899 and 1900, but they had lain idle for many years before being acquired by the present owners in 1926. A new vertical shaft was sunk on the Minto vein to a depth of 340 feet and at the end of 1928 some 59,400 tons of ore of an average value of $9.80 was reported as having been developed on three levels.

Meantime, a shaft had also been started on the Jubilee vein, in November, 1927, and at the end of February, 1929, a 20-ton test mill was set up near the Jubilee shaft to test the ore from the Jubilee vein. Between February, 1929, and March 1, 1930, 2,462 tons of ore was put through the mill, yielding some $8,743 worth of bullion. On March 29, 1930, operations at the Jubilee shaft—now 546 feet deep—were suspended; the pumps withdrawn; and the mine allowed to flood.

In June, 1930, John Knox, Jr., obtained a working option on all mineral rights in the properties owned by Cooper Gold Mines. All the mining and milling plant at the Jubilee mine was moved to the Minto and sufficient new machinery was purchased to convert the old 20-ton test mill into a 75-ton cyanide plant. Early in 1931, the Minto mine, which had been idle since 1928, was re-opened, and stoping started to supply the mill. During 1934, mining was suspended at the Minto shaft and underground operations transferred back to the Jubilee, the ore being hauled to the Minto mill by truck—a distance of about half a mile.

In 1931, 9,448 tons of ore milled yielded bullion to the value of $72,824, or $7.71 a ton; in 1932, 18,765 tons yielded $163,513, or $8.71 a ton; in 1933, 23,671 tons yielded $129,998; and in 1934, 22,189 tons yielded $169,301.[1]

NORTHERN EMPIRE MINE

The property of Northern Empire Mines, Ltd. consists of a large group of claims situated near Empire (or Beardmore) station about 130 miles east of Fort William on the Longlac-Fort William branch of the Canadian National railway.

For several years following the first discovery of gold in the vicinity of Beardmore—which was made in 1925 on part of what is now the Northern Empire mine—development was rather sporadic. In 1927, Beardmore Gold Mines, Ltd. was formed to operate the property. This company was reorganized in January, 1931, as Beardmore Gold Mines Company, Ltd., which in turn became Northern Empire Mines, Ltd. in 1932. This last, which took over the property of Beardmore Gold Mines together with several other groups of claims, is a subsidiary of the Empire Star Mines Company, Ltd., of California, which in turn is controlled by the Newmont Mining Corporation of New York. Just prior to its acquisition by the present owners the property was under option to La Rose Rouyn Mines Ltd., who after doing some diamond-drilling, dropped it for lack of funds. Underground development up to this time amounted to 617 feet of lateral work on two levels; 500 feet of it on the 150-foot level, the remainder on the 75-foot level.

Active development by Northern Empire Mines began in June, 1932, and in 1933 the main vertical shaft was down to 502 feet and new levels had been opened at depths of 300 and 400 feet and in all some 2,764 feet of drifting, cross-cutting, and raising had been done—with such favourable results that a mill of a rated capacity for the treatment of 125 tons of ore a day was decided on and construction commenced in September. Electric power from the Ontario Hydro-Electric Commission's plant at Cameron Falls, 55 miles away, was brought in to the property on August 26, and the old steam-driven plant was replaced by electrical equipment.

---

[1] Gold valued at $20.67 an ounce in 1931, 1932, and 1933; in Canadian funds in 1934.

The mill was brought into operation early in 1934, treating, at first, 80 to 85 tons a day by amalgamation only. Later there was added, first a flotation and next a cyanide plant; and early in 1935, about 120 tons of ore a day was being treated. Production in 1934 amounted to 5,663 ounces of fine gold from 22,507 tons of ore treated.

PARKHILL MINE

The Parkhill mine is a 165-acre property, formerly known as the Longbottom, which adjoins the property of Cooper Gold Mines on the southeast. It was acquired in 1929 by Parkhill Gold Mines, Ltd. (incorporated in April of that year), and a test shipment of 33 tons of high-grade ore was made, which yielded some $62 to the ton in gold. On May 1, 1930, an inclined shaft was started. This was sunk to a depth of 650 feet at an angle of 40 degrees and levels were opened up at depths of 125, 250, 375, 500, and 610 feet. In 1931, a 60-ton cyanide mill was built, from which the first gold brick was shipped in August. In 1932, rated milling capacity was increased to 100 tons of ore a day. On November 6, 1934, the shaft had been sunk to the ninth level, a depth of 1,200 feet on the dip of the vein.

In 1931, 9,082 tons of ore milled yielded bullion to the value of $68,811, or about $7.58 a ton; in 1932, 16,822 tons yielded $146,798; in 1933, 11,565 tons yielded $195,230; and in 1934, 19,431 tons yielded $185,901.[1]

PICKLE CROW MINE

The property of Pickle Crow Gold Mines, Ltd. consists of two groups totalling 57 claims covering approximately 2,500 acres. On the west group of 22 claims, which adjoins the Central Patricia property, rock exposures are few and no mineralization of importance has so far been found; the present workings are situated on the west group of 35 claims, five miles or less east of the Central Patricia mine. Access is by the same general routes as described in connexion with the latter.

The property was staked in 1928, by prospectors in the employ of Northern Aerial Minerals Exploration, Ltd., the name of which company was later changed to Northern Aerial Canada Golds, Ltd. With the exception of trenching on the vein for a distance of about 1,100 feet little work was done till 1933. In April of that year plant and equipment were freighted in and by midsummer shaft-sinking had started. In January, 1934, Pickle Crow Gold Mines, Ltd. was incorporated to take over and work the property. By the end of the year the shaft had reached a depth of 400 feet and levels had been opened up at depths of 125, 250, and 375 feet. The building of a 150-ton mill to treat the ore by a combination of amalgamation and cyanidation was also commenced in 1934 and was completed and in operation in April, 1935. Proven ore reserves at that date were estimated at 50,000 tons carrying on the average 1·05 ounces of gold to the ton. It is planned to open up three more levels—to a depth of 750 feet—after which the mill which is now reported to be handling about 125 tons of ore a day is to be brought up to its rated capacity.

---

[1] Gold at $20.67 an ounce.

ST. ANTHONY MINE

The St. Anthony mine of St. Anthony Gold Mines, Ltd. is situated 12 miles south of Savant Lake station on the Canadian National railway, in the Thunder Bay district. It is reached by a road 3½ miles long, from Savant Lake station to the north end of Sturgeon lake, thence by a water route 8½ miles in length to the mine. The workings are on the west shore of Couture lake, near the North bay of Sturgeon lake.

The first active development of the property was by the Jack Lake Gold Mining Company, in 1900. In 1903, this company brought in and erected on the St. Anthony a 10-stamp mill and other surface equipment that had previously been in use on the Golden Star mine, near Mine Centre, in the Seine River district, where the company had formerly operated. With the exception of a shut-down of some months' duration, in 1907, the mine and mill were in steady operation from 1903 till the early summer of 1908, when work ceased. Between that time and March, 1911, when the Sturgeon Lake Development Company took over the property, some intermittent exploratory work only was done. The new owners remodelled the mill; added a cyanide plant; and carried on until 1913, when operations again ceased. During the summer of 1915 the mine was sampled by the Kerr Lake Mining Company, of Cobalt, who, in 1916, organized the Thunder Mining Co., Ltd. to operate it. In 1917, 3,603 tons of ore was treated from which there was recovered 1,460 ounces of gold and 263 ounces of silver; but before the end of the year the mine was again idle. In 1918, mine and mill were operated for four or five months only; and in 1919 the Thunder Mining Company surrendered its charter and ceased to exist. In 1920, the property was under lease to a syndicate who re-treated some 1,200 tons of tailings in the mill but did no work underground.

In 1928, the property, which had been idle since 1920, was acquired by St. Anthony Gold Mines, Ltd. The underground workings at this time consisted of a shaft 525 feet deep, off which were five levels, on the upper four of which some stoping had been done. It is estimated that gold to a total value approximately $200,000 was produced in the 10-stamp mill up to the end of 1928; and that there was 30,000 tons of material carrying $3.50 a ton in gold on the tailing dump. The new owners ran the mill for a short time in 1929 and 1930, producing 115 ounces of gold in the former and 22 ounces in the latter year, and then again shut down.

After another period of idleness preparations for the resumption of operations at the mine began in the summer of 1933, as a result of some new financing by the owning company. The old milling equipment was discarded, and a start made on the building of a new 125-ton cyanide plant and a 1,000-horsepower hydro-electric power plant—the latter situated on the Sturgeon river about 8 miles from the mine. Both power plant and mill were completed in 1934, power being available at the mine by the end of May. Operation of the mill started in June. For the first few months the mill was fed from old mine dumps and mill tailing; the dewatering of the mine not being completed and actual mining operations started in the old stopes till November. Production to the end of the year was 3,571 ounces of gold and 991 of silver, from 21,618 tons of tailing, dump material, and new-mined ore. It is believed by the management that there is sufficient ore in the old workings to supply the mill at its rated capacity for two years, hence new development work underground was not undertaken until the mine had been brought into production. Since the beginning of 1935 an energetic development campaign has been carried on and on April 1 it was estimated that there was 12,000 tons of broken ore in stopes in addition to that previously estimated as available in the old workings.

QUEBEC

Though the province of Quebec has a long record as a gold producer in a small way—first of placer gold from the valley of Chaudière river, later of by-product gold from the working of copper, lead, and zinc ores in various parts of the province—it is only within the last few years that its output of gold has attained important dimensions. Owing to outstanding developments in the northwestern part of the province, Quebec is now Canada's second largest gold producer, its output of 390,097 ounces in 1934 constituting 13·1 per cent of the total output of the Dominion in that year.

TABLE XLVI

Production of Gold from Quebec Ore, 1877-1934*

Year	Fine ounces**	Value	Year	Fine ounces**	Value	Year	Fine ounces**	Value
		$			$			$
1877	583	12,057	1897	44	900	1916	1,034	21,375
1878	868	17,937	1898	295	6,089	1917	1,511	31,235
1879	1,160	23,972	1899	238	4,916	1918	1,939	40,083
1880	1,605	33,174	1900	....	....	1919	1,470	30,388
1881	2,741	56,661	1901	145	3,000	1920	955	19,742
1882	827	17,093	1902	391	8,073	1921	635	13,127
1883	860	17,787	1903	180	3,712	1922	....	....
1884	422	8,720	1904	140	2,900	1923	667	13,788
1885	103	2,120	1905	191	3,940	1924	883	18,253
1886	193	3,981	1906	165	3,412	1925	1,602	33,116
1887	78	1,604	1907	....	....	1926	3,680	76,072
1888	181	3,740	1908	....	....	1927	8,331	172,217
1889	58	1,207	1909	193	3,990	1928	60,006	1,240,434
1890	65	1,350	1910	124	2,565	1929	90,798	1,876,961
1891	87	1,800	1911	613	12,672	1930	141,747	2,930,170
1892	628	12,987	1912	642	13,270	1931	300,075	6,203,101
1893	759	15,696	1913	701	14,491	1932	401,105	8,291,576
1894	1,412	29,196	1914	1,292	26,708	1933	382,886	7,914,956
1895	62	1,281	1915	1,099	22,720	1934	390,097	8,064,020
1896	145	3 000				Total	1,808,711	37,389,337

* From Dominion Bureau of Statistics Reports.
** Calculated from the value: one dollar=0·048375 ounce.

All Quebec's recorded production up to and including 1900 was placer gold; from 1901 to 1914 it was chiefly lode gold; and since 1914 it has all been lode gold except a few ounces from the Chaudière placers.

Quebec's present high rank among Canada's gold-producing provinces is largely due to the gold production of the Horne copper mine, at Noranda, which in 1934 produced about 64 per cent of the total output of the

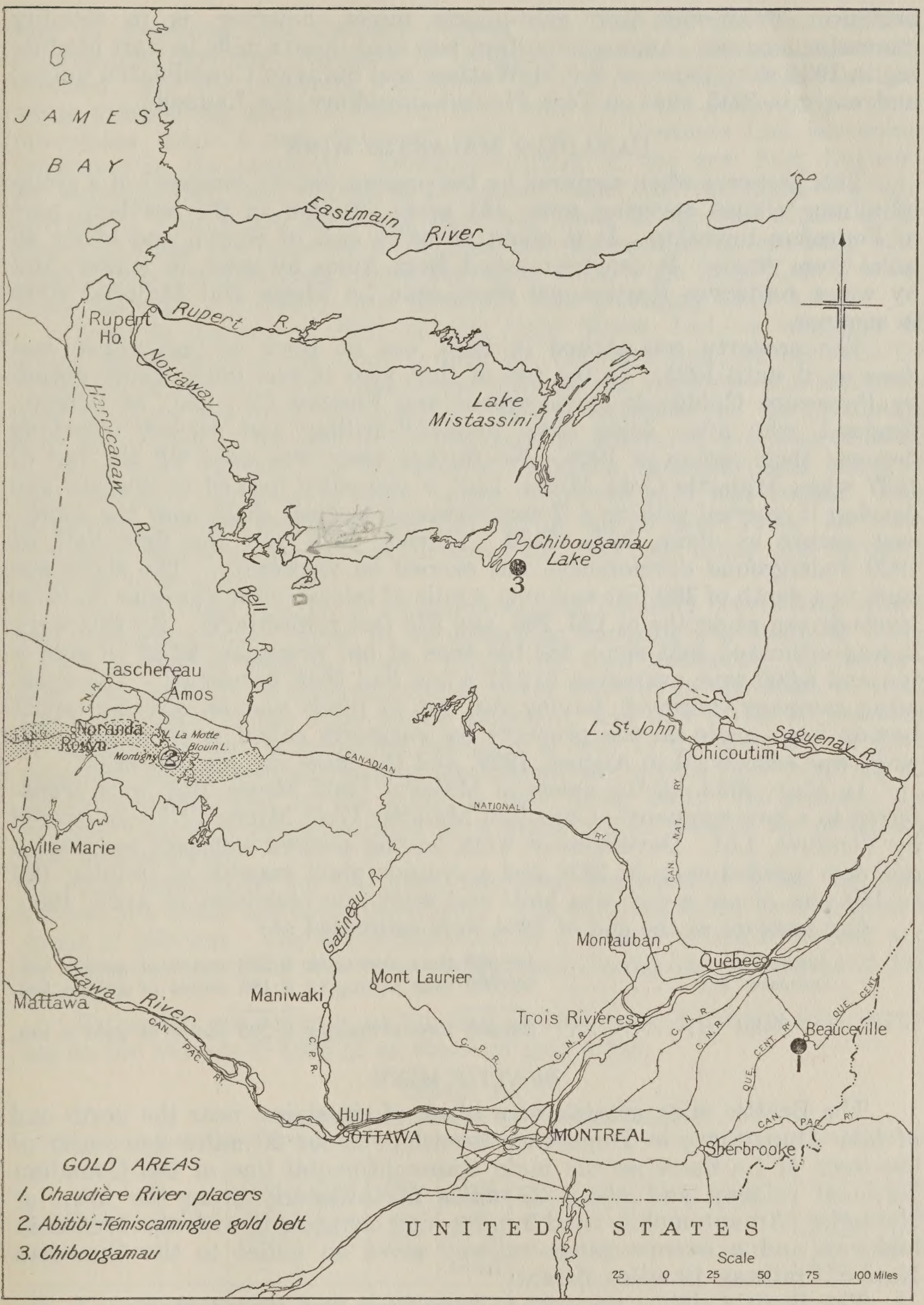
JAMES BAY
Eastmain River
Rupert Ho.
Rupert R.
Nottaway R.
Harricanaw R.
Lake Mistassini
Chibougamau Lake
3
Bell R.
Taschereau
Amos
C.N.R.
T.&N.O.
Noranda
Rouyn
L. La Motte
Blouin L.
Montigny L.
2
CANADIAN NATIONAL RY
L. St John
Chicoutimi
Saguenay R.
CAN. NAT. RY
Ville Marie
Gatineau R.
Montauban
Quebec
Mont Laurier
Maniwaki
Mattawa
Ottawa River
CAN. PAC. RY
C.P.R.
C.P.R.
Trois Rivières
C.N.R.
C.N.R.
C.N.R.
QUE. CENT. RY
QUE. CENT.
Beauceville
1
Hull
OTTAWA
MONTREAL
CAN. PAC. RY
Sherbrooke
UNITED STATES
Scale
25 0 25 50 75 100 Miles
GOLD AREAS
1. Chaudière River placers
2. Abitibi-Témiscamingue gold belt
3. Chibougamau

Figure 7. Key map of gold-bearing areas in Quebec.

province. Production from gold-quartz mines, however, is in steadily increasing amount. Among important new gold-quartz mills to start producing in 1934 were those on the McWatters and Sullivan Consolidated mines; and, early in 1935, that on Teck-Hughes subsidiary, the Lamaque.

CANADIAN MALARTIC MINE

This property when acquired by the present owners consisted of a group of mining claims covering some 443 acres situated in the northern part of Fourniere township. It is about 25 miles east of Rouyn and about 45 miles from Amos. It can be reached from Amos by road, in winter, and by water route via Harricanaw river, lake La Motte and Malartic river in summer.

The property was staked in 1923, but no work of importance was done on it until 1925. In the fall of that year it was taken under option by Porcupine Goldfields Development and Finance Co., Ltd., of London, England, who after doing some diamond-drilling and surface trenching dropped their option in 1926. No further work was done till the fall of 1927 when Malartic Gold Mines, Ltd., a company formed to operate and develop it, started sinking a 2-compartment vertical shaft near the south-east corner of claim M.L. 2129. During 1928 and the first half of 1929 underground development was carried on vigorously. The shaft was sunk to a depth of 390 feet and over a mile of lateral work was done on three levels driven at depths of 125, 250, and 375 feet respectively. By this work it was estimated that some 583,134 tons of ore averaging $3.63 in gold a ton and 6,000 tons averaging $12.57 a ton had been developed. The operating company, however, having run out of funds and an adverse report having been made on the property by engineers called in to examine it, work was suspended in August, 1929, and the mine lay idle till 1933.

In May, 1933, all the assets of Malartic Gold Mines, Ltd. were transferred to a new company—Canadian Malartic Gold Mines, Ltd.—sponsored by Ventures, Ltd. Development work having assured sufficient reserves, a mill was decided upon in 1934 and a cyanide plant capable of treating 125 to 150 tons of ore a day was built and went into operation in April, 1935.

Ore reserves at the end of 1934 were estimated at:

Assured ore	198,000 tons averaging	0·238	ounce of gold a ton.
Indicated ore	340,000 tons averaging	0·186	ounce of gold a ton.
Total	538,000 tons averaging	0·205	ounce of gold a ton.

BEATTIE MINE

The Beattie mine consists of a block of six claims near the north end of lake Duparquet, in Duparquet township, about 20 miles due south of the town of La Sarre on the main transcontinental line of the Canadian National railway and about 22 miles northwesterly from the town of Noranda. An automobile road 9 miles long connects it with the Makamik highway and a narrow gauge railway gives an outlet to the Canadian National railway 19 miles distant.

The Beattie claims are said to have been first staked previous to the Great War. Later, during the Rouyn rush, attention was again attracted to them, and in 1927, 1928, and 1929 considerable exploratory work in the way of trenching and diamond-drilling was done by the Consolidated Mining and Smelting Company of Canada. Results were unsatisfactory, however, and the company withdrew. In October, 1930, John Beattie, while prospecting about a quarter of a mile from the scene of previous operations, made a new discovery which led to Ventures Ltd. becoming interested in the property. Diamond-drilling of the new find, financed by Ventures Ltd., was started in December, 1930, and continued throughout 1931. Thirty-five holes had been put down at the end of the latter year and these are reported to indicate the presence of an ore-body containing over 3,000,000 tons of ore averaging $3.50 a ton in gold, or if lower grade material is included, over 5,000,000 tons averaging $3.07 a ton.

Towards the end of 1931 Beattie Gold Mines, Ltd.—a company of which 50 per cent of the stock is held by Ventures Ltd.; 40 per cent by Nipissing Mines Co., Ltd.; and 10 per cent by the vendors—was incorporated to equip and work the property. It was estimated by the promoters that 90 per cent of the gold in the ore could be recovered at a cost of $2.25 a ton or less. In 1932, the building of a 600-ton flotation plant, the first unit—or pilot plant—of a much larger, projected mill was begun. This was completed and went into operation at the end of May, 1933. In October, 1933, milling capacity was increased to 1,000 tons a day and again in 1934 to 1,100 tons a day.

The first mill product is an arsenical-gold flotation concentrate which was formerly shipped direct to the American Smelting and Refining Company's smelter at Tacoma, Wash., U.S.A., for final treatment. In November, 1934, however, a 200-ton cyanide plant was put in operation to treat the concentrate at the mine before shipment, and now 65 to 70 per cent of its gold content is recovered before it is sent to the smelter. A pilot plant for the further treatment of the concentrate, with a view to saving all the recoverable gold at the mine, is now being built. At present, the cyanide tailing is reconcentrated to a grade which permits its profitable sale to a smelter.

The main shaft on the mine has been deepened to 1,000 feet and several new levels are being developed. The previous lowest level was at a depth of 500 feet. The ore is extracted by a system of spiral stoping and by open-cast methods, the latter being used during the summer and fall months.

Estimated ore reserves at the end of 1934 were 4,131,300 tons carrying on the average 0·1595 of an ounce of gold a ton.

TABLE XLVII

Production Record of Beattie Mine

Year	Ore milled	Gold per ton of ore milled	Total gold in ore milled	Concentrate produced	Gold recovered per ton ore milled	Total recovery				Total cost	
						In concentrate		In bullion		Per ounce of gold produced	Per ton of ore milled
						Gold	Silver	Gold	Silver		
	tons	oz.	oz.	tons	oz.	oz.	oz.	oz.	oz.	$	$
1933[1]...........	145,011	....	....	....	....	22,598	2,850	....	....	32 07	5 00
1934...........	359,200	0·181	65,103	22,458	0·147	48,046	4.716	4,859	859	31 57	4 65

[1] Milling started at the end of May, 1933.

GRANADA MINE

The property of Granada Gold Mines, Ltd., successor to the Granada-Rouyn Mining Company, includes some 6,000 acres of mineral lands in a single block, in Rouyn township, four miles and a half south of the town of Rouyn.

The claims constituting this property were staked in 1922 by R. C. Gamble, president of the present operating company. In 1924 they were under option to McIntyre-Porcupine Mines, Ltd., but after some exploratory work had been done the option was dropped. Late in 1926, Granada-Rouyn Mining Company was formed by the owners to develop the property. The sinking of a two-compartment shaft was started on the Edna Bathurst claim (T-371) in 1927.

In July, 1931, a reorganization of the Granada-Rouyn Mining Company was effected, and its name changed to Granada Gold Mines, Ltd.

In June, 1930, a mill capable of treating about 100 tons of ore a day, was put in operation. In October, 1931, it was reported that the mill, since the commencement of operations, had produced bullion to the value of $350,000 from 30,000 tons of ore, or at the rate of about $12 a ton. Practically all the ore treated up to this time came from the 600- and 500-foot levels. The method of treatment is by amalgamation, concentration, and cyanidation.

In 1934, a Hadsel mill was added to the milling equipment. At this time the deepest level in the mine, which has been opened through two shafts, was at a vertical depth of 1,465 feet, or 2,100 feet measured on the inclination of the vein.

According to the company's annual report for the year ending December 31, 1933: 37,537 tons of ore was milled in that year, yielding $223,111.28, at current price of gold, but operations were conducted at a loss of $92,160.56. Total production from the commencement of operations in July 1930 to the end of 1933 is given as $810,138.70 from 108,010 tons of ore milled.

Early in 1935 a reorganization of the capital structure of the company was approved by the shareholders; and in May it was announced that a new 3-compartment shaft was to be sunk to a depth of 500 feet on the northern portion of the property, at a point about 5,000 feet from the present workings.

GREENE-STABELL MINE

The property of Greene-Stabell Mines, Ltd. consists of 327 acres in Dubuisson township, about 30 miles east of Rouyn. It can be reached from the town of Amos on the Canadian National railway, in winter by a road 50 miles long and in summer by boat up the Harricanaw river to Stabell Landing, which is connected with the mine by a light railway two miles long.

The original claims were staked in 1914—on a promising outcrop of quartz—but underground development was not undertaken until late in 1923 by Stabell Gold Mines, Ltd., a company formed for that purpose. After some preliminary diamond-drilling the sinking of a shaft was begun in October of that year. This at the end of 1924 had reached a depth of

620 feet and two levels, on each of which some 650 feet of drifting had been done, had been opened at depths of 285 and 600 feet respectively. In 1925, work was suspended and the mine allowed to fill with water, in which condition it remained till 1928. In that year Greene-Stabell Mines, Ltd. was incorporated to take over the property and operate it. Dewatering of the shaft was completed in June, and during the following eighteen months two new levels were driven, at depths of 150 and 450 feet in an endeavour to delimit the ore-bodies that had been found by the previous owners. In December, 1929, the mine was again closed down and remained idle till the fall of 1932, when it was again dewatered and sampled.

In the summer of 1933 a 100-ton mill was built which went into operation on November 18, it having been estimated that there was sufficient mineable ore in the known ore-bodies to warrant such a step. The ore treatment process adopted was a combination of amalgamation, concentration and cyanidation. The concentrate, which in addition to gold contains considerable copper, was at first sold to the Noranda smelter; but was being stored at the end of 1934. The total gold production of the mine up to the end of 1934 is reported as approximately 6,987 ounces. In addition there is an average monthly production of about 23,000 pounds of copper in the concentrate.

In 1934, hydro-electric power purchased from the Northern Quebec Power Company displaced the Diesel engines previously in use.

On April 24, 1934, it was estimated that there was a sufficient reserve of ore averaging 0·49 ounce of gold a ton to keep the mill running for two years. Current rate of milling is about 75 tons a day.

LAMAQUE MINE

Lamaque Gold Mines, Ltd.—a subsidiary of Teck-Hughes Gold Mines, Ltd.—owns a group of forty-four claims and fractions covering 2,452 acres in the northwest quarter of Bourlamaque township. The property—previously known as the Read-Authier—includes the La Reine claims of Canadian Exploration, Ltd. Transport to the mine is by water from Amos, via the Harricanaw river.

When taken under option by Teck-Hughes from Read-Authier Mines, Ltd. in 1932 there were two shallow shafts on the property, one 85 and the other 75 feet deep. After doing considerable diamond-drilling, Teck-Hughes formed Lamaque Gold Mines, Ltd., in January, 1933, as a subsidiary to develop and operate the mine and the sinking of two new vertical shafts, Nos. 3 and 4, was started in March. Towards the end of the year another vertical shaft, No. 5, was started. The No. 3 is a 3-compartment shaft sunk near one of the old shafts—the F shaft; No. 4, 600 feet east of No. 3, is a 2-compartment shaft; and No. 5, 1,300 feet southeasterly from No. 3, has three compartments. In 1934 another inclined shaft, No. 6, was started a short distance northeast of No. 3. On January 1, 1935, the vertical depths of these shafts were as follows: No. 3, 721 feet; No. 4, 319 feet; No. 5, 310 feet; and No. 6, 296 feet vertical, or 341 feet on the incline.

After ore had been found on all levels that had been opened up to a depth of 700 feet, plans were made in August, 1934, for the building of a cyanide mill having an initial capacity for the treatment of 225 tons of ore a day and an ultimate capacity for the treatment of 450 tons. The first 225-ton unit of this mill is now in operation.

"Positive" ore reserves on January 1, 1935, were estimated at 74,495 tons containing in the aggregate 465,700 dwt. of gold, or on the average 6·25 dwt. a ton.

McWATTERS MINE

The property of McWatters Gold Mines, Ltd. consists of a group of some 29 claims situated in the southeast quarter of Rouyn township. The mine, on claim R-11604, is connected by road with the town of Rouyn 5½ miles distant.

The original claims, R-11604 to 11608, were first staked in 1922, but gold was not found on them till August, 1932, when spectacular discoveries on R-11604 were followed by a burst of prospecting activity in the surrounding area reminiscent of the years following the discovery of the Horne mine at Noranda. In September, 1932, Dave McWatters acquired the property and shortly afterwards optioned it to Prospectors Airways, Ltd. In December, it was turned over to the newly organized McWatters Gold Mines, Ltd., with Prospectors Airways retaining a one-half interest.

After doing some diamond-drilling a three-compartment shaft was sunk to a depth of 418 feet by July, 1933, since then development has been carried on on three levels, at depths of 150, 275, and 400 feet respectively.

A 50-ton mill to treat the ore by amalgamation was built in 1934, going into operation on September 11; and by the end of the year had produced bullion to the value of $102,113 from 5,081 tons of ore treated. Gold extraction by amalgamation alone is only about 85 per cent, so the mill tailing is impounded for future re-treatment. Early in 1935, it was decided to add a cyanide unit of 150 tons daily capacity to the amalgamation plant, and at the same time increase milling capacity to 100 tons a day. It is expected that these proposed mill expansions will be completed in July, 1935.

Owing to the irregularity of the ore-shoots it is impossible to make a close estimate of ore reserves as yet, but apparently there exists, all of it above the 150-foot level, at least 50,000 tons of unbroken ore carrying $25 worth of gold a ton (with gold at $35 an ounce) and 6,768 tons of broken ore averaging about $15 a ton on the surface ore dump, besides the impounded mill tailing, which is to be re-treated in the new cyanide plant.

NORANDA (HORNE) MINE

The property of the Noranda Mines, Ltd., in northwestern Quebec, consists of some 1,509 acres of mineral lands, in and adjacent to the town of Noranda in Rouyn township. A branch line 44 miles in length connects it with the main line of the Canadian National railway at Taschereau, Quebec, while a second branch line 60 miles in length connects it with the Temiskaming and Northern Ontario railway at Swastika, in Ontario.

The nucleus around which the present property of Noranda mines has grown up was a group of claims, known as the Horne group, the first of which was staked in August, 1920, on an outcrop of gossan near the shore of Osisko lake, by E. H. Horne, a prospector from Ontario. The average value of the outcrops, however, proved to be low and little attention was paid to the discovery until 1923, when trenches and diamond-drilling by the original promoters of the present operating company revealed the presence of solid sulphides rich in copper and gold beneath the lean gossan outcrop. Following this, the development of the property was carried on as rapidly as its, at that time, isolated situation would allow. The results were so favourable that by the end of October, 1926, the Canadian National Railway had completed a branch line to the mine, where a smelter was already under construction; and early in December of the same year the Canada Northern Power Corporation had completed a transmission line over which hydro-electric power was brought to the camp from their generating station on the Quinze river, 50 miles away. In the late fall of 1927, the Temiskaming and Northern Ontario Railway's branch line to the mine had also been completed; and in December the first unit of the smelter was put into operation, the first copper being poured on December 17, 1927. In October, 1928, a mill for the concentration of ore too low-grade for direct smelting was completed and put into operation. The capacity of the concentrator, which when it was first built was 250 tons of ore a day, has been increased from time to time till in April, 1934, it had reached 3,000 tons a day. In 1934, also, new equipment was added to regrind and re-treat the entire mill tailing, resulting in a substantial saving of gold that was formerly lost. Further, an experimental 100-ton cyanide plant was built with a view to extracting additional gold from the pyrite residue of the re-treated mill tailing with results so successful that a 500-ton cyanide mill to treat the entire pyrite portion of the tailing has been built.

The following are the quantities of ore treated in the concentrator since it first went into operation:

1928	4,468 tons
1929	51,689 "
1930	191,856 "
1931	317,792 "
1932	379,637 "
1933	676,168 "
1934	920,363 "

The company's smelter has a rated capacity of approximately 2,000 tons of ore and concentrate a day. Smelting is done in reverberatory furnaces and the resulting blister copper is cast into anodes for shipment to Canadian Copper Refiners, Ltd., at Montreal East, where refined gold, silver, copper, and selenium are produced. In 1935 tellurium also will be added to the list of marketable products obtained from Horne mine ore.

The mine is operated through two main shafts—the No. 3 and the No. 4—about 880 feet apart. From these, levels are driven at intervals of 100 feet in the upper, and 125 feet in the lower portions of the mine, to develop the numerous known ore-bodies. At the end of 1934, the No. 3 shaft was 2,527 feet deep and the No. 4 shaft 3,094 feet.

Shipments of ore from the Horne mine to the smelter and concentrator in 1934 were:

—	Tons	Copper, per cent	Gold, ounces a ton	Silver, ounces a ton
Direct smelting sulphide ore	471,861	3·20	0·232	0·43
Concentrating sulphide ore	918,288	2·34	0·125	0·32
Siliceous fluxing sulphide ore	386,872	0·31	0·134	0·13

In addition to ore from the Horne mine a certain amount of custom ore is occasionally treated in the smelter, but gold production is chiefly from Horne mine ore and concentrate. The record of the smelter since the beginning of operations is as follows:

TABLE XLVIII

Output of the Noranda Smelter, 1927-1934

Year	Tons of ore, concentrate, and refinery slag smelted	Produced		
		Fine copper	Gold	Silver
		pounds	fine ounces	fine ounces
1927	10,740	552,345	767	2,644
1928	271,926	33,065,261	52,949	186,277
1929	428,221	51,223,115	68,732	334,279
1930	734,072	75,509,373	117,393	691,920
1931	765,544	62,859,355	253,363	558,801
1932	918,567	63,013,485	341,350	619,597
1933	1,010,629	65,008,731	284,675	510,730
1934	1,050,684	70,175,512	248,615	552,809

Ore reserves at the end of 1934 were:

—	Tons	Copper, per cent	Gold, ounces per ton
Sulphide ore with over 4 per cent copper	6,826,000	7·25	0·166
Sulphide ore under 4 per cent copper	20,497,000	1·04	0·191
Siliceous fluxing ore	982,000	0·15	0·142

At the present rate of mining sulphide ore this is sufficient to keep the plants operating for eighteen years.

O'BRIEN MINE

The O'Brien mine includes ten contiguous mining claims forming a solid block some 455 acres in extent in Cadillac township. It lies about 30 miles southwesterly from the town of Amos, and can be reached either by motor road or by a water route via the Harricanaw river.

These claims were staked in 1924, on behalf of O'Brien and Fowler, Ltd., who completed the purchase of the mineral rights in 1928. In 1925 a shaft was sunk to a depth of 110 feet, and between 1925 and 1929 some 5,000 feet of drifting, cross-cutting, and raising, as well as some stoping, was done on the 100-foot level. In October, 1929, lateral work from this shaft was stopped but stoping was continued into 1930. A new three-compartment vertical shaft situated some 300 feet east of the old shaft was started in 1930. This new shaft, equipped with a substantial head-frame and heavy hoisting machinery, was completed to a depth of 328 feet early in 1931. Levels were driven from it and considerable work done at depths of 208 and 308 feet (the 2nd and 3rd levels). Towards the end of 1933, it was continued to a depth of 500 feet and new levels established at depths of 400 and 500 feet.

The first gold was produced in 1925, when a bar of bullion weighing 7½ ounces was recovered from specimens. In 1926, 465 pounds of high-grade ore shipped from the property yielded 58·32 fine ounces of gold. Afterwards a number of shipments of selected high-grade material was made, the total value of which is reported to run into the hundreds of thousands of dollars. In 1932 a small mill was built since when production has been continuous.

In September, 1934, the property which previously had been worked as a private enterprise by M. J. O'Brien, Ltd. was turned over to an incorporated company—O'Brien Gold Mines, Ltd.—and stock put on the market. At the time of the transfer the vertical 3-compartment shaft had been sunk to a depth of 529 feet and five levels established at 100-foot intervals, and ore reserves including material from development in a storage dump were estimated at 41,812 tons averaging 0·34 ounce of gold a ton. Total ore milled up to July 14, 1934, is given as 42,692 tons averaging 0·45 ounce a ton.

The mill, which has a rated capacity of 100 tons a day is treating on the average about 80 tons a day. About 70 per cent of the gold in the ore is recovered by amalgamation and a further portion in a concentrate, which it is proposed to cyanide when a plant for that purpose has been built. Since July, 1934, the mine, formerly operating with steam power, has been supplied with electric power by the Northern Quebec Power Company.

In an official report of O'Brien Gold Mines, Ltd., for the period from September 9, 1934 to February 23, 1935, it is stated that during this time 12,752 tons of ore containing 4,161 ounces of gold or 0·326 ounce a ton was treated. Recovery was 92·3 per cent, of which 73 per cent was bullion shipped to the mint and the remainder in concentrate awaiting final treatment. Preparations are under way to sink the main shaft to a depth of 1,000 feet; and plans have been completed for the building of a cyanide plant to treat the accumulated concentrate.

SISCOE MINE

The property of Siscoe Gold Mines, Ltd. includes approximately 1,174 acres in the Harricanaw River section of the northwestern Quebec gold-bearing belt. The mine shafts and surface plant are situated on an island in DeMontigny lake, an expansion of the Harricanaw river, and can be reached from the town of Amos on the main line of the Canadian National railway, some 42 miles away, by motor boat up the Harricanaw in summer and by a snow road in winter.

Gold was found on the shores of lake DeMontigny as early as 1912, and in 1915 or 1916 it was also found on the island which is now the scene of operations of Siscoe Gold Mines, Ltd. The first development work was done by the Siscoe Mining Syndicate, which, in 1920, was incorporated as Siscoe Gold Mines, Ltd. For some time the result of exploration of the property was inconclusive; high-grade ore was found, but the ore-shoots were apparently small and very irregular. Some four or five shafts were sunk, of which the " C " shaft, a single-compartment inclined shaft 600 feet deep measured on its slope of 42 degrees, was the chief working shaft up to 1930. In 1929, a new three-compartment central shaft was started, and this, at the end of 1932 had reached a depth of 1,001 feet and new levels had been run at 725, 850 and 975 feet. In 1934, the main shaft was sunk a further 400 feet and new levels opened.

Early in January, 1929, a 100-ton mill to treat the ore by amalgamation and cyanidation was put in operation. Since then milling capacity has been increased from time to time until it is now in the neighbourhood of 350 tons a day. In 1934, of the total gold in the ore milled 92·03 per cent was recovered by amalgamation, 4·83 per cent by cyanidation, and 3·14 per cent was lost in the tailing.

Broken ore reserves at the end of 1934 was 48,106 tons. Unbroken reserves are not given in the company's annual report.

The production record of the mine is as follows:

TABLE XLIX

Production of the Siscoe Mine[1]

Calendar year	Ore milled	Average value mill feed per ton	Average value per ton lost in tailing	Cost[2] per ton milled	Total value recovered[3]
	tons	$	$	$	$
1929	29,836	10 53	0·230	7 62	307,403 76
1930	33,744	11 11	0·230	7 75	367,266 20
1931	55,675	13 63	0·285	6 63	742,811 76
1932	63,998	15 94	0·219	6 01	1,006,297 49
1933	96,348	12 10	0·345	5 35	1,132,928 73
1934	124,151	17 60	0·551	4 95	2,116,603 49

[1] Compiled from Ann. Repts. of Siscoe Gold Mines, Ltd.

[2] Exclusive of depreciation and taxes.

[3] Figures up to and including those for 1933 are based on gold at $20.67 an ounce; those for 1934 on gold at $35.00 an ounce.

SULLIVAN CONSOLIDATED MINE

The Sullivan mine of Sullivan Consolidated Mines, Ltd. covers some 890 acres situated on the southeast shore of DeMontigny (Kienawisik) lake, about 1½ miles southeast of the Siscoe mine, and like the latter is reached by a water route up the Harricanaw river from the town of Amos.

The original Sullivan claims, which occupy the west part of lot 53, range X and the north part of lots 48, 49, 50 and 51, range IX, Dubuisson township, were staked in 1911 by J. Sullivan and H. Authier, on the first discovery of gold made in this district. Beyond some trenching by J. Sullivan, the owner, which exposed some five main veins, little was done till 1928, when Sullivan Gold Mines, Ltd. was formed to develop the property. In 1929, after doing some diamond-drilling, a shaft was sunk to a depth of 273 feet and stations cut at depths of 150 and 250 feet. Lateral work was started on the lower level and continued till March. 1930, when underground operations were suspended.

In 1932, Sullivan Consolidated Mines, Ltd., a reorganization of Sullivan Gold Mines, Ltd., took over the property, which had been idle since 1930, unwatered the shaft, brought in some new equipment, and started exploratory work on the 150- and 250-foot levels. In 1933, the shaft was deepened to 375 feet and drifting started on the 350-foot level. Operations were again suspended in September but were resumed a few months later.

In January, 1934, the building of a 50-ton mill to treat the ore by amalgamation and cyanidation was begun, and was completed on April 15. Up to December 31, 1934, the mill had produced bullion to the value of $139,907 from 8,187 tons of ore averaging $16.96 a ton at the current price of gold—mostly from development work. Electric power supplied by the Northern Quebec Power Company was brought in to the mine in August, replacing that from Diesel engines previously used.

As of April 1, 1935, indicated ore reserves were estimated at 94,000 tons carrying 0·40 to 0·50 ounce of gold a ton; and it had been decided to increase milling capacity to 100 tons a day.

NOVA SCOTIA

The province of Nova Scotia has the longest continuous record of lode gold production of any province in the Dominion, more or less gold having been produced from the working of gold-quartz mines in each and every year since 1860. The output, never large as compared with that of some of the other gold-producing provinces, latterly has been very small. The most productive period was from 1885 to 1903, when the average annual output was well over 20,000 fine ounces. Immediately following 1903 there was a rapid decline in production, which reached its lowest ebb in 1921, when only 439 ounces was produced. The total recorded production to the end of 1934 is only 930,539 ounces, or well under one-half one year's production in Ontario.

When gold was first found in Nova Scotia is not definitely known. Its presence appears to have been at least suspected before the beginning of the nineteenth century, but it was not until rich discoveries in California had caused world-wide excitement that diligent search was made for it in Nova Scotia. As early as 1849 one John Campbell succeeded in panning gold from beach sand at several places along the sea-shore; and in the spring of 1860, John Pulsiver made a discovery of lode gold in what is now known as the Mooseland gold district, marking the beginning of actual mining. Within a year or two numerous other discoveries had been made at points scattered over the southerly half of the province from Ovens on the west to Isaac Harbour on the east. Up to the present gold has been found in a hundred or more localities, over areas varying in size from less than a square mile to three square miles in extent, dotted over a stretch of country about 275 miles long and from 10 to 75 miles wide.

With the exception of two or three thousand ounces of placer gold won in the early days, chiefly at Ovens, west of Halifax on the south coast, virtually all Nova Scotia's output has been of lode gold. There are hundreds of shallow shafts scattered over the different gold-bearing districts from which more or less gold has been won at some time during the last seventy-five years. Few of the workings, however, have reached a vertical depth of more than 300 or 400 feet, and in only two cases 1,000 feet. For the most part the ores are free-milling and amenable to amalgamation; but a certain amount of gold was also recovered by cyanidation and chlorination; and some auriferous antimony ore and gold-bearing arsenical concentrate have been shipped from the province.

Probably the most extensive workings on any one mine are those on the Richardson mine, in Guysborough county where between 1893 and 1910 a lode varying in thickness from 5 to 25 feet was worked to a vertical depth of about 700 feet. During this time some 53,835 ounces of gold valued at $1,002,965 was recovered from 395,831 tons of ore—an average yield of $2.53 a ton.

The deepest workings in the province were those on the Libbey vein, at Brookfield in Queens county. Here, between 1894 and 1905, an inclined shaft was sunk 1,997 feet, the bottom being 1,062 feet vertically below the surface. During its life this mine produced 36,590 ounces of gold valued at $725,210 from 93,611 tons of ore treated; the average yield being $7.73 a ton.

Also, at Caribou, in Halifax county, workings on the Lake fissure vein were carried to a vertical depth of about 1,000 feet; and 11,854 ounces of gold valued at $225,226 recovered from 47,119 tons of ore; or at the average rate of $4.78 a ton.

In 1934, there was a marked revival of interest in Nova Scotia's latent possibilities for the production of gold, the Annual Report of the Provincial Minister of Mines for 1934 containing a list of some sixty localities in which gold-mining operations were carried on to some extent during the year. A particularly gratifying feature of this renewed activity has been the number of successful gold mine operators from the other provinces of the Dominion and from Great Britain that have entered this field.

A comprehensive detailed account of the Nova Scotia goldfields is contained in Memoir 156 of the Geological Survey of Canada, viz., "Gold Fields of Nova Scotia" by W. Malcolm (1929).

TABLE L

Production of Gold from Nova Scotia Ores, 1862-1934[1]

Year	Fine ounces*	Value	Year	Fine ounces*	Value	Year	Fine ounces*	Value
		$			$			$
1862.....	6,863	141,871	1886...	22,038	455,564	1911...	7,781	160,854
1863.....	13,180	272,448	1887...	20,009	413,631	1912...	4,385	90,638
1864.....	18,883	390,349	1888...	21,137	436,939	1913...	2,174	44,935
1865.....	24,011	496,357	1889...	24,673	510,029	1914...	2,904	60,031
			1890...	22,978	474,990	1915...	6,636	137,180
1866.....	23,776	491,491	1891...	21,841	451,503	1916...	4,562	94,305
1867.....	25,763	532,563	1892...	18,865	389,965	1917...	2,210	45,685
1868.....	19,377	400,555	1893...	18,436	381,095	1918...	1,176	24,310
1869.....	16,855	348,427	1894...	18,834	389,338	1919...	850	17,571
1870.....	18,740	387,392	1895...	21,919	453,119	1920...	690	14,263
1871.....	18,139	374,972	1896...	23,876	493,568	1921...	439	9,075
1872.....	12,352	255,349	1897...	27,195	562,165	1922...	1,042	21,540
1873.....	11,180	231,122	1898...	26,054	538,590	1923...	655	13,540
1874.....	8,623	178,244	1899...	29,876	617,604	1924...	1,047	21,643
1875.....	10,576	218,629	1900...	28,955	598,553	1925...	1,626	33,612
1876.....	11,300	233,585	1901...	26,459	546,963	1926...	1,678	34,687
1877.....	15,925	329,205	1902...	30,348	627,357	1927...	3,151	65,137
1878.....	11,864	245,253	1903...	25,533	527,806	1928...	1,290	26,667
1879.....	12,980	268,328	1904...	10,362	214,209	1929...	2,687	55,545
1880.....	12,472	257,823	1905...	13,707	283,353	1930...	1,272	26,295
						1931...	460	9,509
1881.....	10,147	209,755	1906...	12,223	252,676	1932...	964	19,928
1882.....	13,307	275,090	1907...	13,675	282,686	1933...	1,382	28,568
1883.....	14,571	301,207	1908...	11,842	244,799	1934[2]...	3,525	72,868
1884.....	15,168	313,554	1909...	10,193	210,711			
1885.....	20,945	432,971	1910...	7,928	163,891	Total..	930,539	19,236,030[3]

---

* Calculated from the value: one dollar=0·048375 ounce.

[1] From Dominion Bureau of Statistics Reports.

[2] Figures subject to revision.

[3] The above record does not take into account any gold won prior to 1862, though actual mining began in 1860; neither does it make any allowance for the stealing of gold by miners, a practice that is said to have been extremely prevalent at one time; nor for clandestine production, an incentive to which is found in the fact that all the gold won was subject to royalty and that in the earlier days the collection of the royalty was not carried out with any very great efficiency. The value of the gold unaccounted for, for these reasons, has been variously estimated by different writers at anything from $1,000,000 to $5,000,000.

University of Toronto Library
SCIENCE & MEDICINE DEPARTMENT

Not access.
Gov.Doc. Canada. Mines, Bureau of
Can Gold in Canada,1935, by A.H.A.Robinson.
M (No.769).
University of Toronto Library

University of Toronto Library

DO NOT
REMOVE
THE
CARD
FROM
THIS
POCKET

Acme Library Card Pocket
LOWE-MARTIN CO. LIMITED

H. Fors